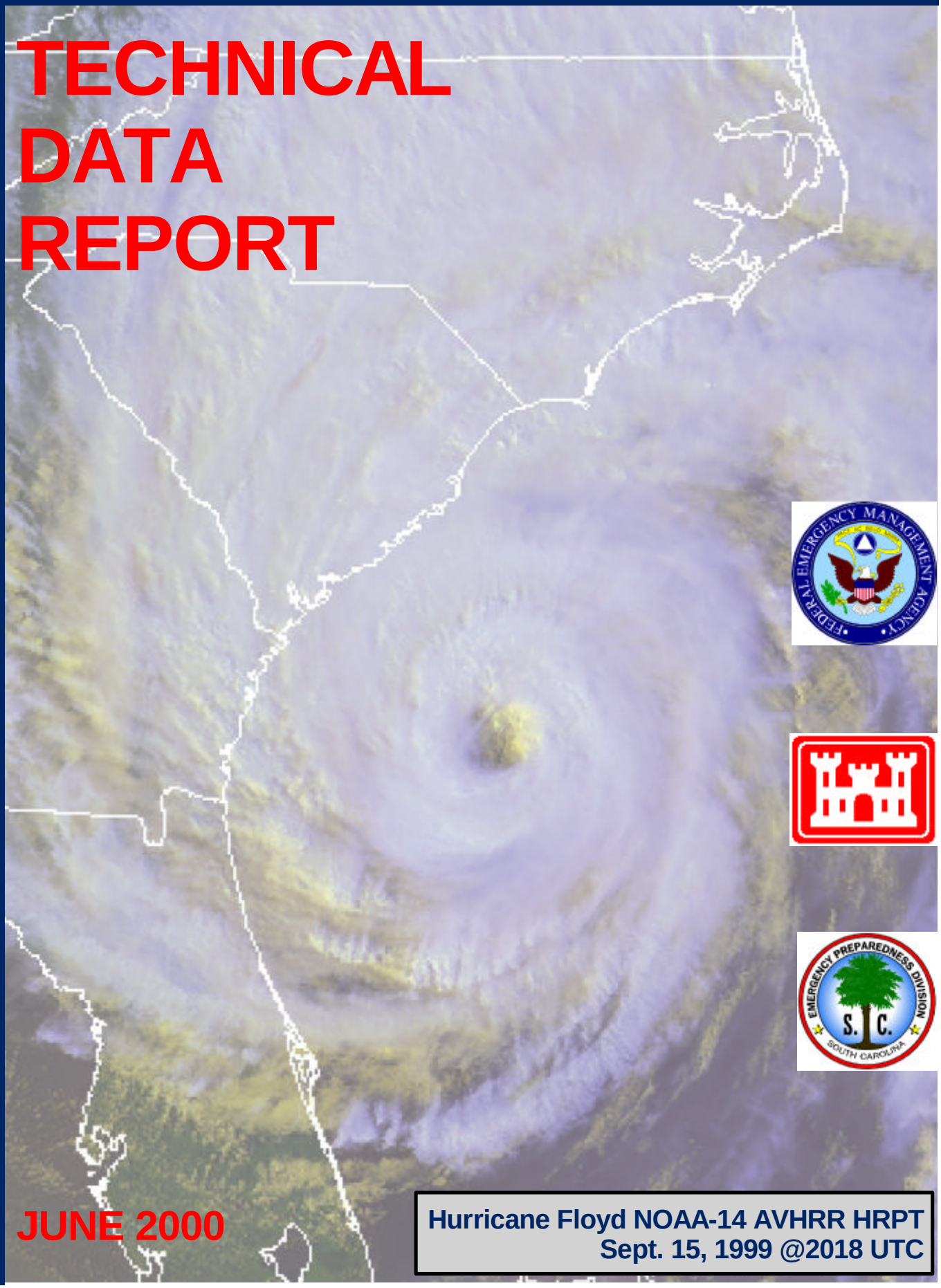
South Carolina Hurricane Evacuation Restudy

TECHNICAL DATA REPORT



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Preface

Although there are regions of lightly populated communities along the South Carolina coast where private islands and wildlife refuge areas are found, the majority of the coastline is heavily populated and is continuing to grow. This increase in population results in an increase in the number of people impacted by a hurricane event and increased traffic on the roads during evacuation. Due to the low-lying topography of the South Carolina coast, potential storm surges are some of the highest along the south Atlantic coast. These factors present emergency officials with a difficult task of developing hurricane evacuation plans that will be reasonably safe and effective.

Government officials and citizens alike must understand that the South Carolina coast will be struck by a catastrophic hurricane some time in the future and that preparedness is of utmost importance. Obtaining information critical to prompt and effective hurricane evacuation planning requires comprehensive and specialized analyses. In order to provide the needed technical information, the Federal Emergency Management Agency, the U.S. Army Corps of Engineers and the National Oceanic and Atmospheric Administration have joined the South Carolina Emergency Preparedness Division and local emergency management agencies in the conduction of the South Carolina Hurricane Evacuation Restudy.

Appreciation is expressed for participation and direct contributions by the National Hurricane Center and the National Weather Service for their expert knowledge in hurricane storm surge modeling; and Post, Buckley, Schuh, & Jernigan for the transportation analysis completed for this restudy.

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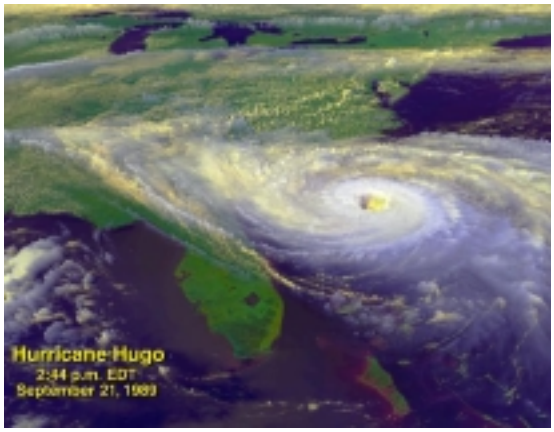
CHAPTER ONE - INTRODUCTION

1.1 STUDY PURPOSE



The purpose of this Hurricane Evacuation Study is to provide emergency management officials with information that could assist them in hurricane evacuation decision-making. The technical data presented in this report can be used by County and State Agencies to supplement their hurricane evacuation plans and operational procedures in response to future hurricane threats.

1.2 FUNDING

The Study was funded by the Federal Emergency Management Agency (FEMA) and the U.S. Army Corps of Engineers (USACE). The State of South Carolina's Emergency Preparedness Division along with local community officials and agencies provided valuable data and coordination throughout the study at their own expense.

1.3 AUTHORITY

The authority for the U.S. Army Corps of Engineers' participation in this study is Section 206 of the Flood Control Act of 1960 (Public Law 86-645). The Federal Emergency Management Agency's participation is authorized by the Disaster Relief Act of 1974 (Public Law 93-288). These laws authorize the allocation of resources for planning activities related to hurricane preparedness.

1.4 DESCRIPTION OF STUDY AREA

1.4.1. Geography

The South Carolina study area is shown in Figure 1-1. The study area includes the coastal counties of Jasper, Beaufort, Colleton, Charleston, Georgetown, and Horry. The inland counties are Hampton, Dorchester, and Berkeley. Due to the transportation analysis, other counties were included as required. Coastal South Carolina reflects three geographical areas: the long concave strand stretching from the North Carolina state line south to Winyah Bay; the Santee River delta and barrier islands of Cape Romain-Bulls Bay; and the sea islands of the central and southern coast. While physiographically different, these three areas share two commonalities. All are more or less low-lying and all are separated from the mainland by wide expanses of salt marshes, estuaries, tide-influenced rivers, and/or belts of rivers and marshes paralleling the coastline. South Carolina has approximately 190 miles of open coastline, but its numerous, bays, estuaries, inlets, and rivers create an actual shoreline of over 3000 miles. Most of the shoreline has beautiful white sand beaches with shallow clean waters. Excellent roads across the entire coastal area along with moderate weather conditions has made it an outstanding scenic and tourist attraction and a very desirable place to live.

Behind the barrier islands and beaches is a complex system of creeks, estuaries, tidal rivers and thousand of acres of salt marshes, whose vast expanses are broken occasionally by hummocks of varying sizes. All along the coast a series of cuts and channels tie rivers, sounds, and bays into the Intracoastal Waterway. Inland the marshes and hummocks gradually give way to the terrestrial environment of the coastal plain. The outer coastal plain (to 80 miles inland and less than 100 feet above sea level) is marked by extensive freshwater swamps grading into the coastal salt marshes. South Carolina's northern coastline in the Grand Strand is fronted by a smooth hard shore cut by a few small inlets. The lower coast is fringed by sea islands and salt marshes.

Tides are higher – the range between high and low tide levels greater – in the lower coastal around the Beaufort area than along the Grand Strand. This is significant only in terms of awareness of probabilities for increased flooding along South Carolina's southern coast should a hurricane strike during normal high tides or spring tides. Mean tide range is about 3.4 feet above Mean Low Water (MLW) at the entrance to Port Royal Sound (lower South Carolina coast), 2.7 feet above MLW at the entrance to Charleston Harbor (central South Carolina coast), and 2.3 feet above MLW at the entrance to Murrells Inlet (upper South Carolina coast).

1.4.2. Geology and Soils.

The study area is located in the Atlantic Coastal Plain of South Carolina, which extends from the Fall Line to the present-day coast. The Fall Line is defined by an eroded, winding boundary between the exposed rocks of the Piedmont province on the northwest side of the line and the younger sediments of the Coastal Plain to the southeast. The Fall Line geologically splits the state, trending in a southwesterly direction from Chesterfield County on the north side of state to Edgefield County on the southeast side of the state. Stream gradients change dramatically across this line.

The geologic profile of the Coastal Plain generally consists of pre-Meozic crystalline rocks and sedimentary rocks lying within buried basins from the Triassic and Jurassic periods and overlain by sediments ranging from Upper Cretaceous to recent Quaternary. The Atlantic Ocean has covered nearly all of the Coastal Plain during the geologic past. Arches and basins are featured in the surface of the basement rock lying beneath the Coastal Plain sediments causing the formation of both embayments and protruding landforms that are aligned perpendicular to the coastline. Much of the Coastal Plain in South Carolina lies within the Charleston embayment, which is located between two major arches or upwarps. To the north is the Cape Fear arch near the South Carolina-North Carolina border and to the south is the Yamacraw arch near the South Carolina-Georgia border. Coastal Plain sediments are ordinarily thicker at the embayments and thinner over the arches.

Coastal Plain sediments were deposited during periods of fluctuation in sea level. During periods of relatively higher sea levels, deposition of marine and shoreline sediments occurred. Conversely, during periods when the sea level fell, the coastline receded to the east, the Coastal Plain eroded, and streams became entrenched. The younger results of this action are along the present-day coast and the older ones are inland at progressively higher elevations toward the fall line. Coastal Plain sediments include fluvial, marginal marine and marine sediments, which were deposited during these transgressive-repressive cycles.

The Atlantic Coastal Plain is divided into inner, middle, and outer portions. The inner Coastal Plain lies next to the Fall Line and slopes toward the Atlantic Ocean. The general topography of the Inner Coastal Plain is characterized by numerous, deeply eroded stream channels which has an elevation greater than 290 ft National Geodetic Vertical Datum of 1929 (NGVD). The Orangeburg scarp cuts across the Inner Coastal Plain in South Carolina, marking a boundary between the inner and middle portions of the Coastal Plain. This scarp was formed by wave erosion during a higher sea level period. The surface of the Middle Coastal Plain lies between about elevation 100 and elevation 290 and has been eroded by streams, but to a somewhat lesser degree than the Inner Coastal Plain. The Outer Coastal Plain lies below about elevation 100, and is low, relatively flat, sloping gently seaward. It consists of a series of terraces formed by

partially filled backbarrier, barrier island, and shallow marine shelf deposits. The modern shoreline along the northern portion of the coast can be characterized as embayed having extensive barrier beaches, and cut by estuaries extending across the Coastal Plain sometimes reaching into the Fall Line. The southern portion of the South Carolina shoreline is characterized by the presence of sea islands, and having a smoother coastline and smaller estuaries lacking the extensive barrier beaches present in the northern section. Soils of the modern barrier islands are primarily Holocene sands. Pleistocene sediments, interbedded sands and clays of backbarrier and barrier origin, comprise the remainder of the Outer Coastal Plain

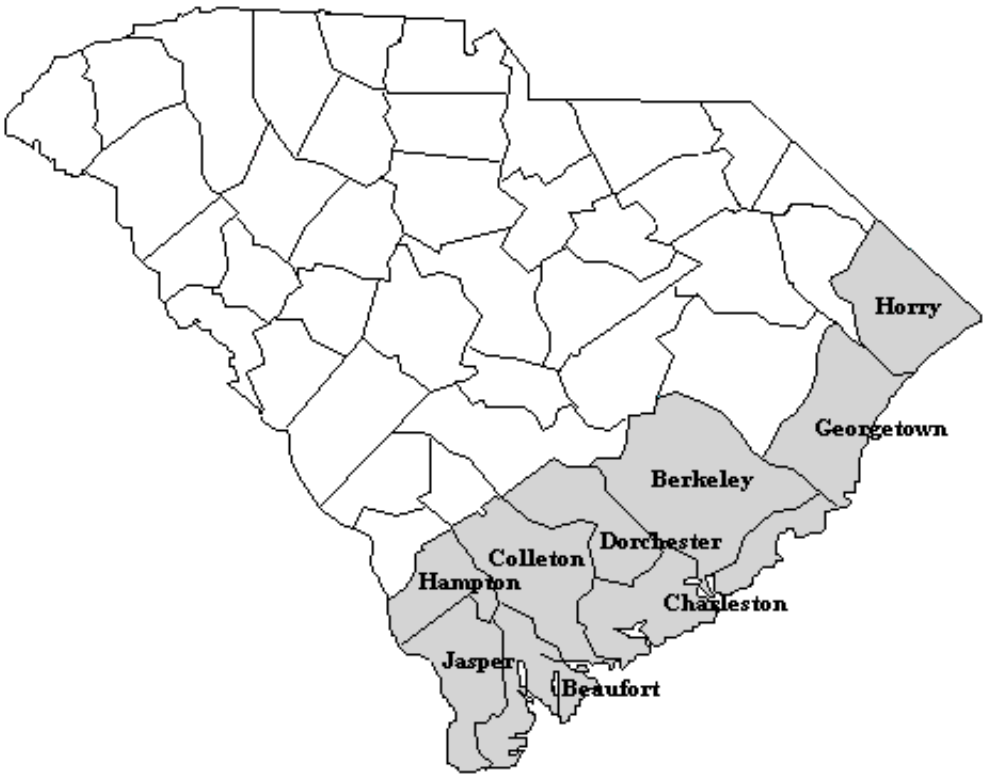


Figure 1-1 General Map of the Study Area

1.4.3. Bathymetry

Shallow water close to shore, tends to increase the magnitude of hurricane-induced storm surge, therefore the depth of water offshore (bathymetry) is extremely important. Off the Grand Strand Area in Horry County (upper South Carolina coast) the 20-foot water depth is about 2,000 to 3,000 feet offshore, the 30-foot water depth is about 3 miles offshore, and the 60-foot depth is about 19 miles out. As you move south toward Charleston (central South Carolina coast) these depths of 20-foot and 30-foot depths get farther offshore. The 20-foot water depth is about 1 to 2 miles offshore, the 30-foot water depth is about 3 to 4 miles offshore and the 60-foot depth remains about 19 miles out. In the

area around Beaufort and Hilton Head (lower South Carolina coast) these depths are fairly consistent with the depths off of Charleston.

The lower and central South Carolina coastline is banded with barrier islands which divide a number of sounds and bays from the Atlantic Ocean. These sounds and bays are also relatively shallow with maximum depths to about 20 to 40 feet in Port Royal Sound and St Helena Sound, 1 to 5 feet in Sewee and Bulls Bay, 10 to 20 feet in Winyah Bay, and 1 to 5 feet in Mud Bay.

1.4.4. Population

The study area is generally rural with most of the population concentrating along the coastal areas. The following table shows the estimated population for the study area counties for the years 1990 to 2000. The estimated growth rate from 1990 to 2000 is also shown. The population figures were obtained from the South Carolina State Budget and Control Board, Office of Research and Statistics.

Table 1-1 Population Characteristics For the South Carolina Study Area Counties

COUNTY NAME	1990 Population	Estimated Population Year 2000	1990-2000 Growth as a Percent
Beaufort	86,425	109,200	26.4 %
Berkeley	128,776	149,100	15.83 %
Charleston	295,041	311,700	5.6 %
Colleton	34,377	38,600	12.3 %
Dorchester	83,060	97,800	17.7 %
Georgetown	46,302	53,700	16 %
Hampton	18,191	19,700	8.3 %
Horry	144,053	199,700	38.6 %
Jasper	15,487	18,200	17.5 %

1.5 HISTORICAL HURRICANE ACTIVITY

1.5.1. General

Hurricanes are a classification of tropical cyclones which are defined by the National Weather Service as nonfrontal, low pressure synoptic scale (large scale) systems that develop over tropical or subtropical waters and have a definite organized circulation.
The classification of tropical cyclones into tropical depressions, tropical storms, or hurricanes depends upon the speed of the sustained (1-minute average) surface winds near the center of the system. Tropical depressions are $\leq$ 33 knots (38 mph), tropical storms are 34 to 63 knots (37-74 mph) inclusive, and hurricanes are $\geq$ 64 knots (75 mph).

The geographical areas affected by tropical cyclones are referred to as tropical cyclone basins. The Atlantic tropical cyclone basin is one of six in the world and includes much of the North Atlantic Ocean, the Caribbean Sea, and the Gulf of Mexico. The official Atlantic hurricane season begins on June 1 and extends through November 30 of each year; however, occasional tropical cyclones can occur outside of this period.

Early season tropical cyclones are almost exclusively confined to the western Caribbean and the Gulf of Mexico. However, by the end of June or early July, the area of formation gradually shifts eastward, with a slight decline in the overall frequency of storms. By late July, the frequency begins to slowly increase, and the area of formation shifts still farther eastward. By late August, tropical cyclones form over a broad area which extends eastward to near the Cape Verde Islands off the coast of Africa. The period from about August 20 through September 15 produces the most severe hurricanes, many of which travel across the entire Atlantic Ocean. After mid-September, the frequency begins to decline and the formative area retreats westward. By early October, the area of maximum occurrence returns to the western Caribbean. In November, the frequency of tropical cyclone occurrence further declines.

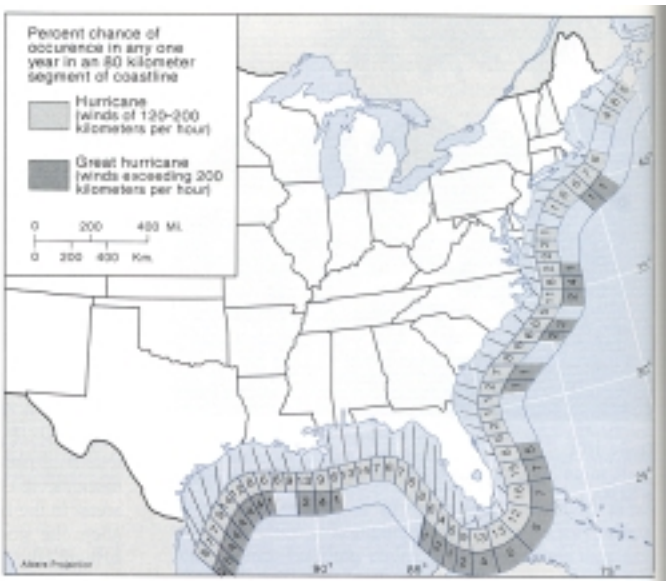
1.5.2. Atlantic Tropical Cyclone Basin

Through the research efforts of the National Climate Center in cooperation with the National Hurricane Center, records of tropical cyclone occurrences within the Atlantic tropical cyclone basin have been compiled dating back to 1871. Although other researchers have compiled fragmentary data concerning tropical cyclones within this basin back to the late fifteenth century, the years from 1871 to the present represent the complete period of the development of meteorology and organized weather services in the United States. For the 120-year period from 1871 through 1990, about 1000 tropical cyclones have occurred within the Atlantic tropical cyclone basin. Data for the years 1871 through 1885 do not allow accurate determinations of the intensities of the storms

occurring during those years; because the National Hurricane Center only maintains detailed computer files of the Atlantic tropical cyclone tracks back to 1886. Of the 889 known Atlantic tropical cyclones of at least tropical storm intensity occurring during the period 1886 through 1990, 519 (58%) are known to have reached hurricane intensity.

1.5.3. Historical Hurricanes in South Carolina

Between 1900 and 1999, 14 tropical cyclones of hurricane intensity made direct hits on the South Carolina Coastline. Of these 14 storms, 4 were major storms (3, 4, and 5 by Saffir/Simpson category). Since 1900, no category 5 hurricane has hit South Carolina; there has been two category 4's (Hugo, 1989 and Hazel, 1954); and two category 3's (Gracie, 1959 and Sept.17, 1945). Storms were not formally named before 1950. It is possible that the "Great Storm of 1893" which struck the southern coast in August of that year was at least a category 4 storm, but there is no way of knowing since accurate measures of tropical cyclone intensity are not available before 1900.



In the colonial period, tropical storms and hurricanes were known as "September gales" probably because the ones people remembered and wrote about were those which damage or destroyed crops just before they were to be harvested. Historical accounts of some of these events are presented below.

One that struck "Charles Town" September 25, 1686 was "wonderfully horrid and distructive…corne is all beaten down, and lyes rotting on the ground… Aboundance of our hoggs and cattle were killed in the Tempest by the falls of trees…" The writer goes on to say that the storm also prevented a Spanish assault upon Charles Town by destroying one of their galleys and killing the Commander in chief.

In Autumn of 1700, "a dreadful hurricane happened at Charleston Town which did great damage and threatened the total destruction of the Town, the lands of which it is built being low and level and not many feet above high water mark, the swelling sea rushed in

with amazing impetuosity, and obliged the inhabitants to fly for shelter…" A ship, Rising Sun, out of Glasgow and filled with settlers had made port just prior to the storm's landfall. It was dashed to pieces and all on board perished.

Of a storm which passed inland along the coast September 7-9, 1854, Adele Pettigru Allston wrote from Pawleys Island, "The tide was higher than has been known since the Storm of 1822. Harvest had just commenced and the damage to the crops is immense. From Waverly to Pee Dee not a bank nor any appearance of land was to be seen…(just) one rolling, dashing Sea, and the water was Salt as the Sea."

By 1893, major population centers could be telegraphically alerted to storms moving along the coast, but there were no warning for the sea islands and other isolated areas.

The "Great Storm of 1893" struck the south coast at high tide, pushing an enormous storm surge ahead of it, creating a "tidal wave" that swept and submerged whole islands. Maximum winds in the Beaufort area were reported at 125 mph; those in Charleston at 120 mph. Water from the first wave probably stacked up in the marshes, held there by the winds until the next high tide, which was after the storm had passed. Lowered barometric pressure and the amount of "stacked" water caused destruction equal to that of a "tidal wave." At least 2000 people lost their lives, and an estimated 20,000-30,000 were left homeless and with no means of subsistence.

Charleston Battery – Hurricane of 1911

Hazel, (October, 1954) and Gracie, (September, 1959), were the most memorable storms of the 50's. Hazel, A category 4 storm, made landfall near Little River, South Carolina with 106 mph winds and tides up to 16.9 feet. One person was killed and damage was estimated at $ 1.7 billion.**

Gracie, a category 3 hurricane made landfall at St. Helena Island, and continued north-northwest maintaining hurricane strength for more than a hundred miles inland. Damage of disaster proportions occurred along the coast from Beaufort to Charleston. Heavy rains caused flooding through much of the state, crop damage was severe, but there was no loss of life.

The most recent memorable storm was Hurricane Hugo. Hugo struck Charleston, South Carolina on September 21, 1989 as a category 4 storm. Hugo ranked as the eleventh most intense hurricane at time of landfall to strike the United States this century and is rated as the second costliest hurricane with over $8.5 billion** in damages. Hugo's storm surge was the highest ever recorded on the East Coast and exceeded 20 feet NGVD just north of Charleston. The total number of deaths associated with Hugo is 82.

**Adjusted to 1996 dollars on basis of U.S. Dept. of Commerce Implicit Price Deflator for Construction.

1.6 MAJOR ANALYSES

The South Carolina Hurricane Evacuation Study consists of several related analyses that develop technical data concerning hurricane hazards, vulnerability of the population, public response to evacuation advisories, timing of evacuations, and sheltering needs for various hurricane threat situations. The major analyses are briefly summarized in the following paragraphs. Detailed descriptions of the analyses and the methodologies of each are contained in subsequent chapters of this report.

1.6.1. Hazards Analysis

The Hazards Analysis determines the timing and magnitude of wind and storm surge hazards that can be expected from hurricanes of various categories, tracks, and forward speeds. The Sea, Lake, and Overland Surges from Hurricanes (SLOSH) numerical models were used by the National Hurricane Center to compute surge heights. Three SLOSH models were used (Wilmington, Charleston, and Savannah). Hazards from freshwater flooding are based on the Flood Insurance Rate Maps. The Hazards Analysis is presented in more detail in Chapter Two.

1.6.2. Vulnerability Analysis

Utilizing the results of the Hazards Analysis, the Vulnerability Analysis identifies those areas, populations, and facilities that are vulnerable to specific hazards under a variety of hurricane threats. Inundation maps were produced and evacuation scenarios were developed. Hurricane evacuation zones were delineated for the each of the nine counties in the study area. Population data were used to determine the vulnerable population within each evacuation zone. In areas of potential inundation, critical facilities were identified, such as family care homes, nursing homes, and hospitals. Further discussion on all aspects of the Vulnerability Analysis is provided in Chapter Three.

1.6.3. Behavioral Analysis

This analysis determines the expected response of the population threatened by various hurricane events in terms of the percentage expected to evacuate, probable destinations of evacuees, public shelter use, and utilization of available vehicles. The methodology employed to develop the behavioral data relied on discussions concerning expected behavioral response with emergency management staff in each county, review of past behavioral studies as a part of various hurricane planning efforts conducted by U.S. Army Corps of Engineers, and FEMA and behavioral research by Hazards Management Group for the region; particularly behavioral data collected for the 1996 Bertha/Fran responses in Horry County. A thorough presentation of the Behavioral Studies can be found in Chapter Four.

1.6.4. Shelter Analysis

The Shelter Analysis presents an inventory of pre-designated public shelter facilities, capacities of the shelters, vulnerability of shelters to storm surge flooding, and shelter demand for each county. Shelter inventories were furnished by emergency management offices in each county. Shelter demands were estimated from behavioral analysis data. Chapter Five contains additional information on the Shelter Analysis.

1.6.5. Transportation Analysis

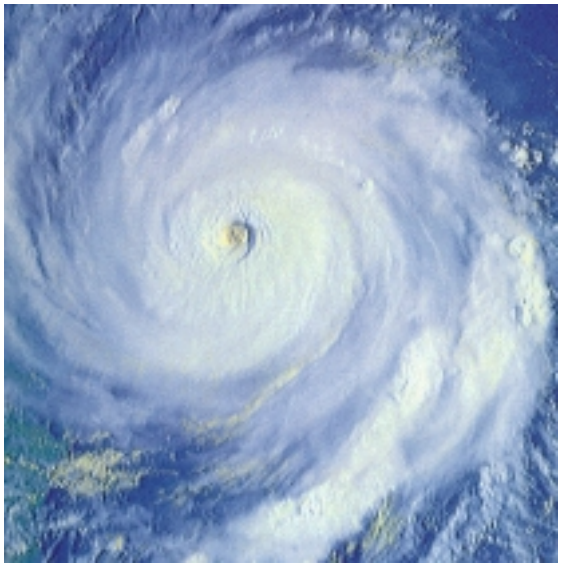
The principal purpose of the Transportation Analysis is to determine the time required to evacuate the threatened population (clearance times) under a variety of hurricane situations and to evaluate traffic control measures that could improve the flow of evacuating traffic. Transportation computer modeling techniques developed to simulate hurricane evacuation traffic patterns were used to conduct this analysis. To provide a better estimate of where these people will travel to, behavioral studies were made to

estimate what portion of the evacuees will go to other inland counties or seek safe haven in Georgia or other destinations. Complete details on the Transportation Analysis is presented in Chapter Six.

1.7 COORDINATION

A comprehensive coordination program was established for the South Carolina Hurricane Evacuation Restudy that included state and local emergency management officials and representatives from other organizations having direct responsibilities in hurricane emergencies.

CHAPTER TWO - HAZARDS ANALYSIS



The purpose of the hazards analysis is to quantify the wind speeds and still-water surge heights for hurricanes that have a reasonable meteorological probability of occurring in the study area. Freshwater flooding from heavy rainfall accompanying hurricanes is an additional hazard that must be considered.

The primary objective of the hazards analysis is to determine the probable worst-case effects from hurricanes of various intensities that could strike the region. For the purposes of this study, the term worst-case is used to describe the peak surges and wind speeds that can be expected at all locations within the study area without regard to hurricane track.

2.1 FORECASTING INACCURACIES

The worst-case approach is used in the hazards analysis because of inaccuracies in forecasting the precise tracks and many other parameters of approaching hurricanes. The National Hurricane Center has made an analysis of hurricane forecasts to determine the normal magnitude of error. From 1988 to 1997, the average error in the official 24-hour hurricane track forecast was 101 statute miles left or right of the forecast track. The average error in the 12-hour official forecast was 54 miles.

During the same time period, the average error in the official 24-hour wind speed forecast was 11 knots (kts), and the average error in the 12-hour official forecast was 7 kts. (To convert wind speed from knots to miles per hour, multiply knots by 1.150779) Hurricane evacuation decision-makers should note that an increase of 10 to 15 kts could easily raise the intensity value of the approaching hurricane one category on the Saffir/Simpson Hurricane Scale, which is discussed in the following paragraph. Other factors may work to increase apparent hurricane surge heights above the potential heights calculated by the numerical storm surge model developed by Jelesnianski (1967, 1972 and Taylor (1973) and Jelensianski *et al* (1984) that calculates sea, lake and overland surges known by the acronym “SLOSH”. Because of these forecast and modeling inaccuracies, public officials who are faced with an imminent evacuation should consider preparing for a hurricane at landfall that may be one category above the forecast strength.

2.2 SAFFIR/SIMPSON HURRICANE SCALE

One of the earlier guides developed to describe the potential storm surge generated by hurricanes is the Saffir/Simpson Hurricane Scale. It was developed by Herbert Saffir, Dade County, Florida, Consulting Engineer, and Dr. Robert H. Simpson, former Director of the National Hurricane Center. The National Hurricane Center has added a range of central barometric pressures associated with each category of hurricane described by the Saffir/Simpson Hurricane Scale. A condensed version of the Saffir/Simpson Hurricane Scale with the barometric pressure ranges by category is shown in Table 2-1. The related damage potential of each hurricane category is described in Table 2-2.

Table 2-1 Saffir/Simpson Hurricane Scale

Category	Central Pressure Millibars	Central Pressure Inches	Winds (mph)	Winds (kts)	Damage
1	> 980	> 28.94	74-95	64-83	Minimal
2	965-979	28.50 - 28.91	96-110	84-96	Moderate
3	945-964	27.91 - 28.47	111-130	97-113	Extensive
4	920-944	27.17 – 27.88	131-155	114-135	Extreme
5	< 920	< 27.17	> 155	> 135	Catastrophic

Table 2-2 Saffir/Simpson Hurricane Category Damage Scale
Category 1. Winds of 74 to 95 miles per hour. Damage primarily to shrubbery, trees, foliage, and mobile homes. No real wind damage to other structures. Some damage to poorly constructed signs. Low-lying coastal roads inundated, minor pier damage, some small craft in exposed anchorage torn from moorings.
Category 2. Winds of 96 to 110 miles per hour. Considerable damage to shrubbery and tree foliage; some trees blown down. Major damage to exposed mobile homes. Extensive damage to poorly constructed signs. Some damage to roofing materials of buildings; some window and door damage. No major wind damage to buildings. Considerable damage to piers. Marinas flooded. Small craft in unprotected anchorage's torn from moorings.
Category 3. Winds of 111 to 130 miles per hour. Foliage torn from trees; large trees blown down. Practically all poorly constructed signs blown down. Some damage to roofing materials of buildings; some window and door damage. Some structural damage to small buildings. Mobile homes destroyed. Serious flooding at coast and many smaller structures near coast destroyed; larger structures near coast damaged by battering waves and floating debris.

Table 2-2 Saffir/Simpson Hurricane Category Damage Scale
Category 4. Winds of 131 to 155 miles per hour. Shrubs and trees blown down; all signs down. Extensive damage to roofing materials, windows, and doors. Complete failure of roofs on many small residences. Complete destruction of mobile homes. Major damage to lower floors of structures near shore due to flooding and battering by waves and floating debris. Major erosion of beaches.
Category 5. Winds greater than 155 miles per hour. Shrubs and trees blown down; considerable damage to roofs of buildings; all signs down. Very severe and extensive damage to windows and doors. Complete failure of roofs on many residences and industrial buildings. Extensive shattering of glass in windows and doors. Some complete building failures. Small buildings overturned or blown away. Complete destruction of mobile homes.

2.3 STORM SURGE

2.3.1. Introduction

Various storm events can cause abnormally high water levels along ocean coasts and interior shorelines. These higher than expected water levels, known as storm surges, are generally the result of a synoptic scale meteorological disturbance. Storm surges can affect a shoreline over distances of more than 100 miles; however, there may be significant spatial variations in the magnitude of the surge due to local bathymetric and topographic features. Wind is the primary cause of storm surge. Wind blowing over the surface of the water exerts a horizontal force that induces a surface current in the general direction of the wind. The surface current, in turn, forms currents in subsurface water. In the case of a hurricane, the depth affected by this process of current creation depends upon the intensity and forward motion of the storm. For example, a fast-moving hurricane of moderate intensity may only induce currents to a depth of a hundred feet, whereas a slow moving hurricane of the same intensity might induce currents to several hundred feet. As the hurricane approaches the coastline, these horizontal currents are impeded by a sloping continental shelf, thereby causing the water level to rise. The amount of rise increases shoreward to a maximum level that is often inland from the usual coastline.

2.3.2. Factors Affecting Surge Height

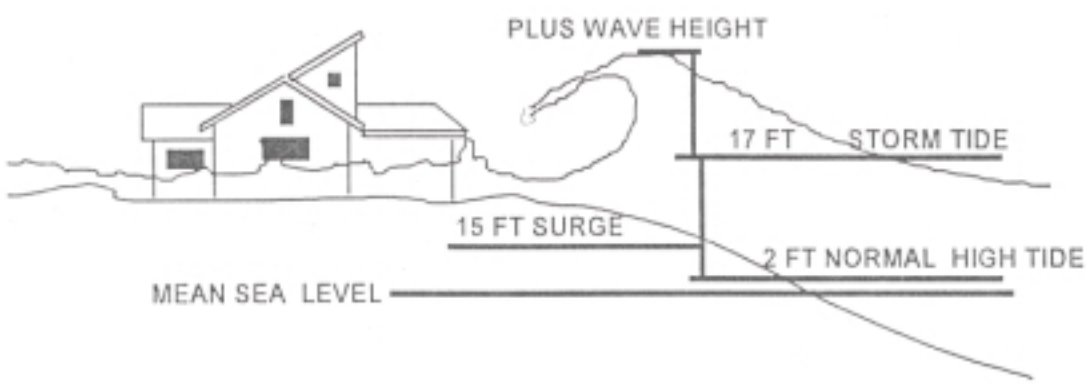
The elevation reached by the storm surge within a coastal basin depends upon the meteorological parameters of the hurricane and the physical characteristics existing within the basin. The meteorological parameters affecting the height of the storm surge include the intensity of the hurricane, measured by the storm-center sea-level pressure, track (path) of the storm, forward speed, and radius of maximum winds. Due to the

complementary effects of forward motion and the counterclockwise rotation of the wind field, highest surges from a hurricane usually occur on the northeast quadrant of the storm's track in the region of the radius of maximum winds. This radius, which is measured from the center of the hurricane eye to the location of the highest wind speeds within the storm, can vary from as little as 4 miles to as much as 50 miles or greater. Peak storm surge may vary drastically within a relatively short distance along the coastline depending on the radius of maximum winds and the point of hurricane eye landfall.

The physical characteristics of a basin that influence the surge heights include the basin bathymetry (water depths), roughness of the continental shelf, configuration of the coastline, and natural or man-made barriers. A wide, gently sloping continental shelf or a large bay may produce particularly large storm surges.

2.3.3. Total Flood Elevation

Other factors that contribute to the total water height are the initial water level within the basin at the time the hurricane strikes and wave effects. Storm surge is defined as the difference between the observed water level and the normal astronomical tide. Any astronomical tide level above the mean is additive to the storm surge. The timing of the arrival of storm surge is important in that the difference in total flood elevation can be as much as 3.5 to 5 feet in the study area.



Waves breaking near the shore cause a transport of water shoreward. When there is an increase in wave height water cannot flow back to the sea as rapidly as it came in. This phenomenon, known as "wave setup", increases the water level along the beachfront. Waves will break and dissipate their energy in shallow water. Therefore, a relatively steep offshore beach slope allows large ocean waves to get closer to the shore before breaking and usually promotes larger waves. Wave setup is primarily a concern near the beachfront because waves are generally not transmitted inland of the coastline even if the beach has been overtopped.

2.4 THE SOUTH CAROLINA SLOSH COMPUTER MODELS

2.4.1. GENERAL

The Sea, Lake, and Overland Surges from Hurricanes (SLOSH) models were developed by the National Weather Service to calculate potential surge heights from hurricanes. The SLOSH models for the South Carolina Hurricane Evacuation Restudy were run under contract by the Storm Surge Group, National Hurricane Center, National Centers for Environmental Prediction, National Oceanic and Atmospheric Administration, Miami Florida. The SLOSH models are used for real-time forecasting of surges from approaching hurricanes within selected Atlantic coastal basins (Wilmington, Charleston, and Savannah). In addition to computing surge heights for the open coast, the SLOSH models have the added capability to simulate the routing of storm surge into sounds, bays, estuaries, and coastal river basins, as well as calculating surge heights for overland locations. Significant natural and manmade barriers are represented in the models and their effects simulated in the calculations of surge heights within a basin.

The SLOSH models are designed for use in an operational mode; that is, for forecast/hindcast runs without controlled, local calibration, or observed winds. This design was selected so that the user would not be forced to estimate unavailable input data. The SLOSH models contain a storm model into which simple, time-dependent meteorological data are input and from which the driving forces of a simulated storm are calculated. These data are as follows:

(1) Central barometric pressure at 6-hour intervals.

(2) Latitude and longitude of storm positions at 6-hour intervals for a 72-hour tract.

(3) The storm size measured from the center (eye) to the region of maximum winds, commonly referred to as the radius of maximum winds. Wind speed is not an input parameter, since the model calculates a windfield for the modeled storm by balancing forces according to meteorological input parameters.

Also required is the height of the water surface well before the storm directly affects the area of interest. This initial height is the observed, quiescent, water surface height occurring about 2 days before storm arrival, including any existing anomalous rise in the water surface. Astronomical high tide was not set in the model.

The values or functions for the coefficients within the SLOSH models are generalized to serve for modeling all storms within all basins and are set empirically through

comparisons of computed and observed meteorological and surge height data from numerous historical hurricanes. The coefficients are a function of differing storm parameters and basin characteristics. Calibration of the model based on a single storm event within a basin is avoided since there is no guarantee that the same coefficient values will serve as well for other storms.

2.4.2. SLOSH Grid Configuration

The Wilmington/Myrtle Beach SLOSH grid is a telescoping elliptical coordinate system with 75 arcs (i) and 115 radials (j) as shown in figure 2-1. The area covered by the grid is called a "basin"—the "Wilmington/Myrtle Beach Basin." The resolution of the Wilmington/Myrtle Beach grid is approximately 0.1 square miles per grid square closest to the pole (i=1) and about 10.3 square miles at the maximum distance from the pole (i=75). The Charleston SLOSH grid is a telescoping hyperbolic coordinate system with 95 arcs (i) and 150 radials (j) as shown in figure 2-2. The resolution of the Charleston grid is approximately 0.1 square miles per grid square closet to the pole (i=1) and about 6.8 square miles at the maximum distance from the pole (i=95). The Savannah/Hilton Head Slosh grid is a telescoping polar coordinate system with 100 arcs (i) and 94 radials (j) as shown in figure 2-3. The Savannah/Hilton Head grid is approximately 0.1 square miles per grid square closest to the pole (i=1) and about 11.6 square miles at the maximum distance from the pole (i=100). The advantage of these grid systems is that they offer good resolution in areas of primary interest, while conserving computer resources and minimizing calculations.

The characteristics of a particular basin are constructed as input data within the model. These characteristics include the topography of inland areas; river basins and waterways; bathymetry of nearshore areas, sounds, bays, and large inland waterbodies; significant natural and manmade barriers such as barrier islands, dunes, roads, levees, et cetera; and a segment of the continental shelf. The SLOSH model simulates inland flooding from storm surge and permits the overtopping of barriers and flow through barrier gaps.

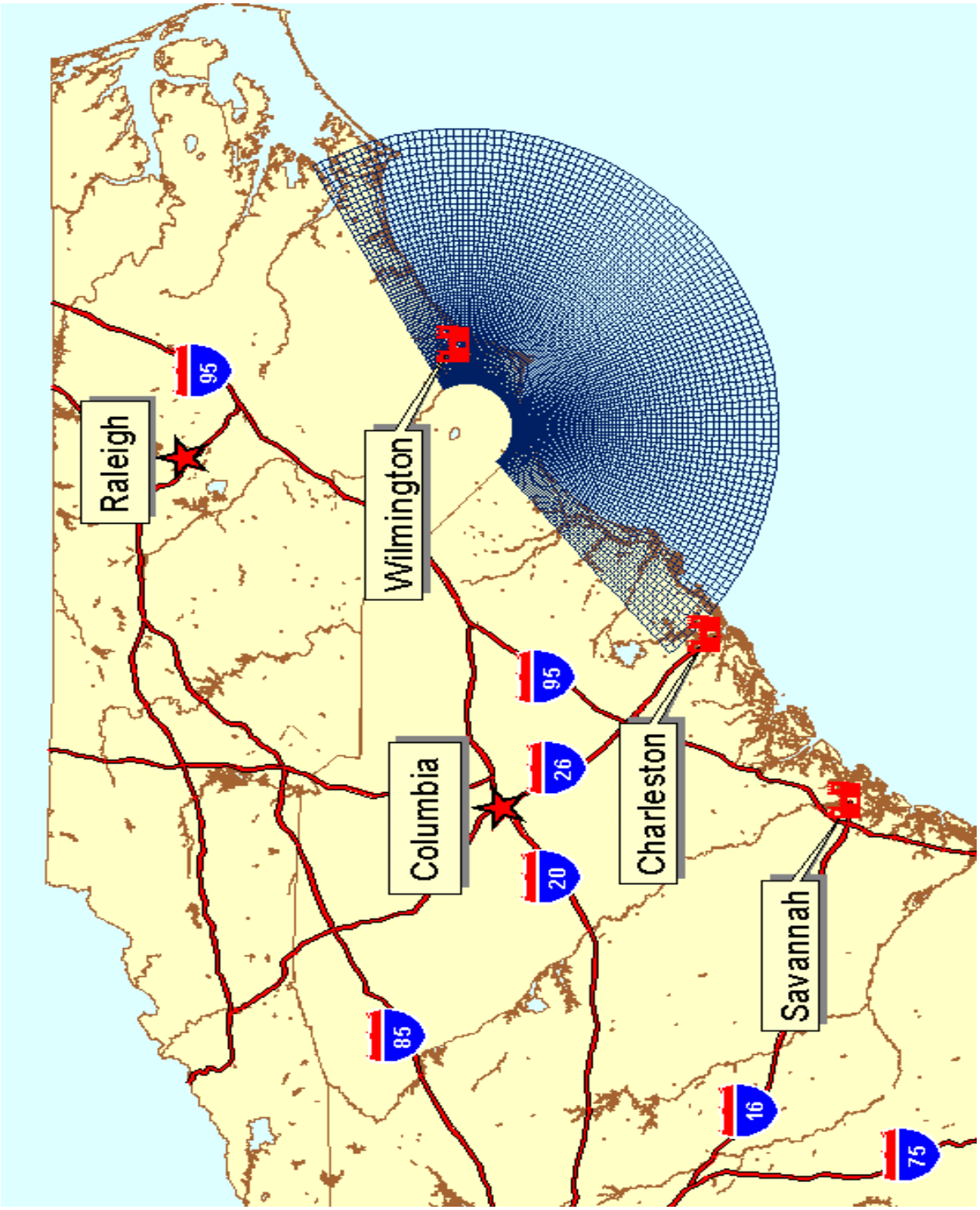


Figure 2-1 Wilmington/Myrtle Beach SLOSH Model Grid

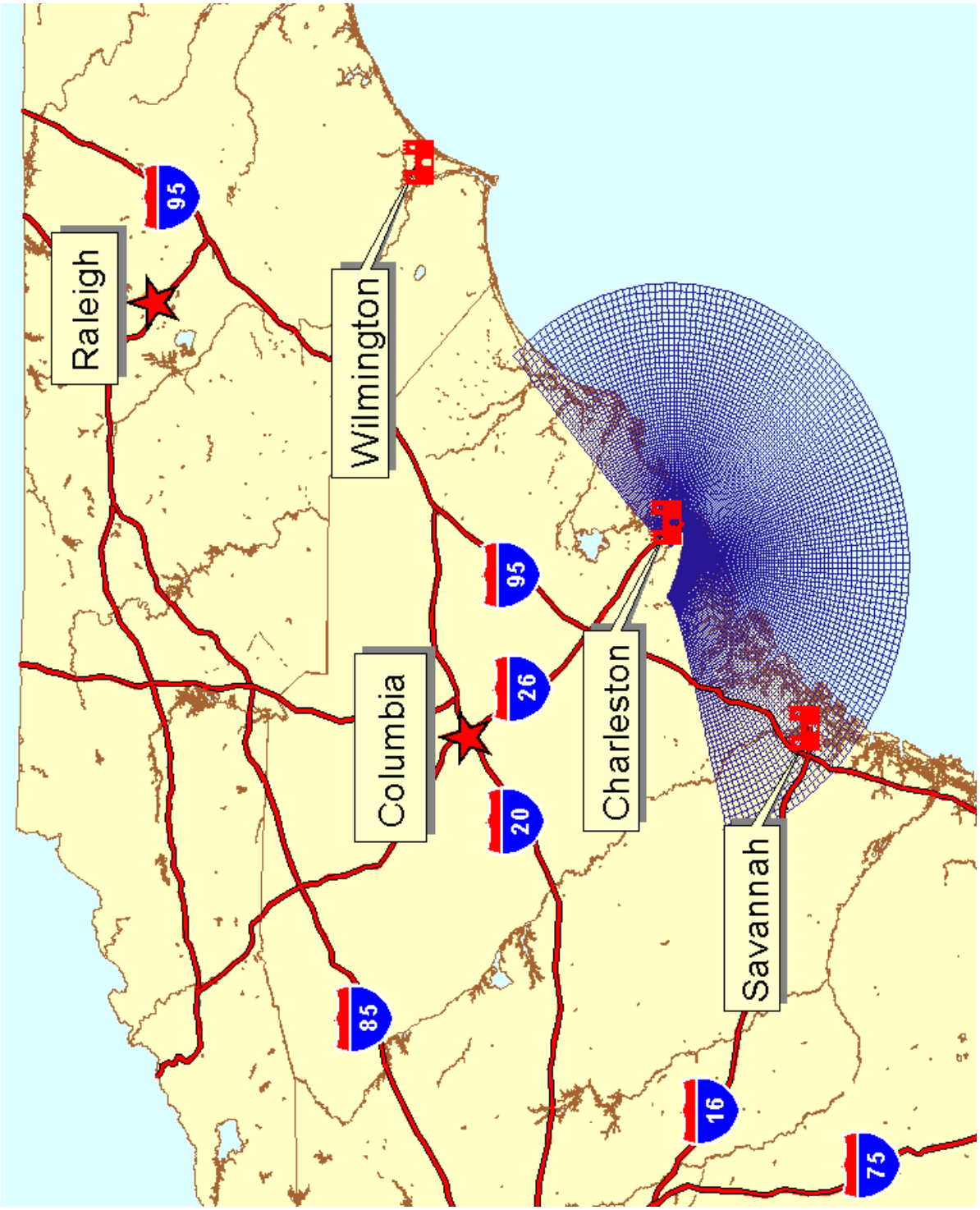


Figure 2-2 Charleston SLOSH Model Grid.

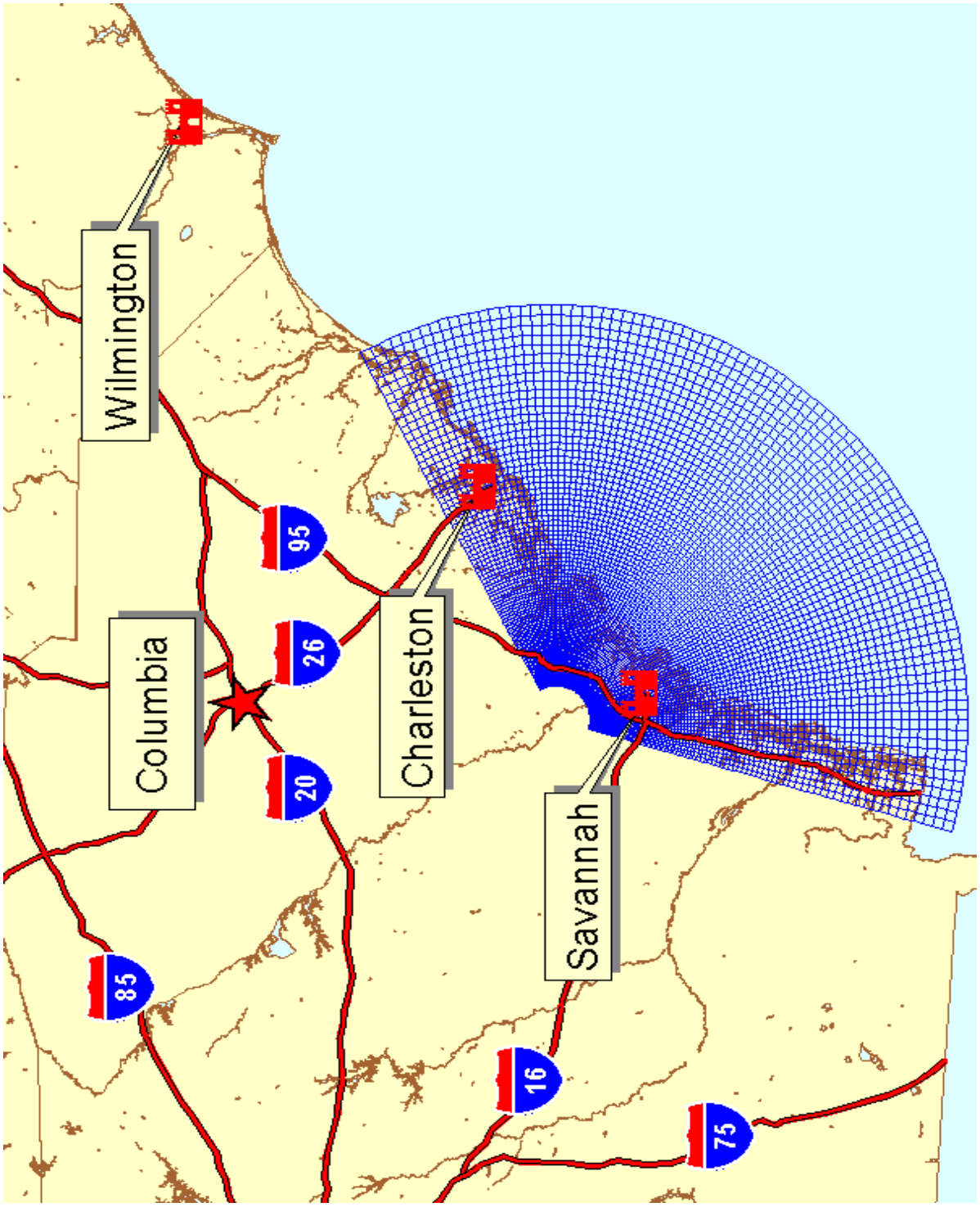


Figure 2-3 Savannah/Hilton Head SLOSH Model Grid.

2.4.3. Verification of the Model

After a SLOSH model has been constructed for a coastal basin, verification experiments are conducted. These experiments are performed as real-time operational runs in which available meteorological data from historical storms are input in the model. These input data consist solely of observed or hindcast storm parameters and an initial observed sea surface height occurring approximately 48 hours before the storm makes landfall or affects the basin. The computed surge heights are compared with those measured from historical storms and, if necessary, adjustments are made to the input or basin data. In instances where the model has given realistic results in one area of a basin, but not in another, closer examination has often revealed inaccuracies in the representation of barrier heights or missing values in bathymetric or topographic charts. When necessary, further analysis and subjective decisions are employed to amend the track or other parameters of the historical storms used in the verification process.

2.4.4. Model Output

The SLOSH model output for a modeled storm consists of a tabulated storm history containing hourly values of storm position, speed, direction of motion, pressure drop, and radius of maximum winds; a surface envelope of highest surges; and for pre-selected grid points, time-history tabulations of values for surge heights, wind speeds and wind directions. Values in the time-history tabulations are 10-minute averages, given every 30 minutes.

The highest water level reached at each location along the coastline during the passage of a hurricane is called the maximum surge. Maximum surges along the coastline do not necessarily occur at the same time. The time of the maximum surge for one location may differ by several hours from the maximum surge that occurs at another location. The SLOSH model determines the highest surge height values calculated for each grid in the model irrespective of the time of occurrence. The datum used in the model is NGVD, formerly known as mean sea level of 1929 (m.s.l.).

2.5 THE WILMINGTON/MYRTLE BEACH MODELING PROCESS

The Wilmington/Myrtle Beach Basin SLOSH model was used to determine the surge heights in Horry and Georgetown Counties in South Carolina. A total of 1450 hypothetical hurricanes were modeled for the Wilmington/Myrtle Beach Basin. The

characteristics of the simulated hurricanes were determined from an analysis of historical hurricanes. The parameters selected for the modeled storms were the intensities, forward speeds, approach directions, and radii of maximum winds that are considered to have the highest meteorological probability of occurrence within the region. The parameters are summarized in Table 2-3. The simulated hurricanes included category 1 through category 5 hurricane intensities and seven approach directions. Forward speeds of 5, 15, 25 and 35 miles per hour were used. The radius of maximum winds specified for all the simulated hurricanes at landfall was 20 miles.

Table 2-3. Wilmington/Myrtle Beach basin's hypothetical storms: Directions, speeds, (Saffir/Simpson) intensities, number of tracks and the number of runs.

Direction	Speed (mph)	Intensities	Tracks	Runs
W	5, 15, 25	Cat1-Cat5	8	120
WNW	5, 15, 25	Cat1-Cat5	10	150
NW	5, 15, 25,35	Cat1-Cat5	11	220
NNW	5, 15, 25,35	Cat1-Cat5	15	300
N	5, 15, 25,35	Cat1-Cat5	14	280
NNE	5, 15, 25,35	Cat1-Cat5	11	220
NE	5, 15, 25,35	Cat1-Cat5	8	160
				Totals = 1,450

After making landfall, most hurricanes weaken because the central pressure increases (the storm "fills") and the radius of maximum winds tends to increase. This was taken into account in modeling each of the storm tracks. The initial sea surface height set in the Wilmington/Myrtle Beach Basin SLOSH model was 1.0 foot. This initial height, known as tide anomaly, represents the height of the water surface above mean sea level existing several days in advance of approaching hurricanes. Based on observations from tide gauges in the area of this basin, tide anomalies of about 1.0 feet above mean sea level before arrival of a hurricane are not uncommon. Furthermore, to simulate conditions at high tide, an additional 2.5 feet was included. Thus all SLOSH runs of hypothetical hurricanes were supplied with an initial datum of + 3.5 feet MSL, and the resulting calculations of storm surge represent conditions at time of high tide.

2.6 THE CHARLESTON MODELING PROCESS

The Charleston SLOSH model was used to determine the surge heights in Georgetown, Charleston, Berkley, Dorchester, and Colleton Counties in South Carolina. A total of 1540 hypothetical hurricanes were modeled for the Charleston Basin. The characteristics of the simulated hurricanes were determined from an analysis of historical hurricanes. The parameters selected for the modeled storms were the intensities, forward speeds, approach directions, and radii of maximum winds that are considered to have the highest meteorological probability of occurrence within the region. They are summarized in Table 2-4. The simulated hurricanes included category 1 through category 5 hurricane intensities and seven approach directions. Forward speeds of 5, 15, 25 and 35 miles per hour were used. The radius of maximum winds specified for all the simulated hurricanes at landfall was 20 miles.

Table 2-4 Charleston basin's hypothetical storms: Directions, speeds, (Saffir/Simpson) intensities, number of tracks and the number of runs.

Direction	Speed (mph)	Intensities	Tracks	Runs
W	5, 15, 25	Cat1-Cat5	9	135
WNW	5, 15, 25	Cat1-Cat5	15	225
NW	5, 15, 25,35	Cat1-Cat5	15	300
NNW	5, 15, 25,35	Cat1-Cat5	14	280
N	5, 15, 25,35	Cat1-Cat5	12	240
NNE	5, 15, 25,35	Cat1-Cat5	9	180
NE	5, 15, 25,35	Cat1-Cat5	9	180
				Totals = 1,540

After making landfall, most hurricanes weaken because the central pressure increases (the storm "fills") and the radius of maximum winds tends to increase. This was taken into account in modeling each of the storm tracks. The initial sea surface height set in the Charleston Basin SLOSH model was 1.0 foot. This initial height, known as tide anomaly, represents the height of the water surface above mean sea level existing several days in advance of approaching hurricanes. Based on observations from tide gauges in the area of this basin, tide anomalies of about 1.0 feet above mean sea level before arrival of a hurricane are not uncommon. Furthermore, to simulate conditions at high tide, an

additional 2.5 feet was included. Thus all SLOSH runs of hypothetical hurricanes were supplied with an initial datum of + 3.5 feet MSL, and the resulting calculations of storm surge represent conditions at time of high tide.

2.7 THE SAVANNAH/HILTON HEAD MODELING PROCESS

The Savannah/Hilton Head Basin SLOSH model was used to determine the surge heights in Colleton, Hampton, Beaufort and Jasper Counties in South Carolina. A total of 1540 hypothetical hurricanes were modeled for the Savannah/Hilton Head Basin. The characteristics of the simulated hurricanes were determined from an analysis of historical hurricanes. The parameters selected for the modeled storms were the intensities, forward speeds, approach directions, and radii of maximum winds that are considered to have the highest meteorological probability of occurrence within the region. The parameters are summarized in Table 2-5. The simulated hurricanes included category 1 through category 5 hurricane intensities and seven approach directions. Forward speeds of 5, 15, 25 and 35 miles per hour were used. The radius of maximum winds specified for all the simulated hurricanes at landfall was 20 miles.

Table 2-5. Savannah/Hilton Head basin's hypothetical storms: Directions, speeds, (Saffir/Simpson) intensities, number of tracks and the number of runs.

Direction	Speed (mph)	Intensities	Tracks	Runs
W	5, 15, 25	Cat1-Cat5	13	195
WNW	5, 15, 25	Cat1-Cat5	15	225
NW	5, 15, 25,35	Cat1-Cat5	15	300
NNW	5, 15, 25,35	Cat1-Cat5	13	260
N	5, 15, 25,35	Cat1-Cat5	13	260
NNE	5, 15, 25,35	Cat1-Cat5	10	200
NE	5, 15, 25,35	Cat1-Cat5	5	100
				Totals = 1,540

After making landfall, most hurricanes weaken because the central pressure increases (the storm "fills") and the radius of maximum winds tends to increase. This was taken into account in modeling each of the storm tracks. The initial sea surface height set in the Savannah/Hilton Head Basin SLOSH model was 1.0 foot. This initial height, known as tide anomaly, represents the height of the water surface above mean sea level existing

several days in advance of approaching hurricanes. Based on observations from tide gauges in the area of this basin, tide anomalies of about 1.0 feet above mean sea level before arrival of a hurricane are not uncommon. Furthermore, to simulate conditions at high tide, an additional 4.0 feet was included. Thus all SLOSH runs of hypothetical hurricanes were supplied with an initial datum of +5.0 feet MSL, and the resulting calculations of storm surge represent conditions at time of high tide.

2.8 MAXIMUM ENVELOPES OF WATER (MEOWS)

The highest surges reached at all locations within the affected area of the coastline during the passage of a hurricane are called the maximum surges for those locations; the highest maximum surge in the affected area is called the peak surge. The location of the peak surge depends on where the eye of a hurricane crosses the coastline, hurricane intensity, the bathymetry of the basin, configuration of the coastline, the approach direction, and the radius of maximum winds. As discussed previously, the peak surge from a hurricane usually occurs to the right of the storm path and within a few miles of the radius of maximum winds.

Due to the inability to precisely forecast the ultimate landfall location, forward speed, approach direction, and other characteristics of a threatening hurricane, the objective of the hazards analysis is to determine the potential peak surges for all locations within the study area. For that purpose, MEOWs are utilized. MEOWs were developed by the National Hurricane Center from an array of peak surges calculated for individual hurricanes that differ only in point of landfall. In this manner, maximum water surface elevations are calculated for a particular class of hurricane defined by approach direction, forward speed, and intensity but independent of the point of landfall.

Initially, 130 MEOWs were developed for each of the Wilmington/Myrtle Beach, Charleston and Savannah/Hilton Head SLOSH models. These MEOWs consisted of computer printouts showing peak surge values developed for each combination of category, approach speed, and approach direction modeled for the study, without regard to storm track. Therefore, the values contained on these original MEOWs were the peak surge height values for each of the model's grid points regardless of where landfall may have occurred.

The results of the 390 original MEOWs were analyzed to determine which changes in storm parameters (i.e., intensity, approach speed, and approach direction) resulted in the greatest differences in the values of the peak surges for all locations and those that could

reasonably be combined to facilitate evacuation decision-making. In most instances, a change in storm category accounted for the greatest change in peak surge heights. With this in mind, careful consideration was given to the impacts of the various combinations of approach speeds, approach directions, and Saffir/Simpson categories on hurricane evacuation planning and decision-making. To simplify these processes, the National Hurricane Center was asked to compile additional MEOWs.

The National Hurricane Center subsequently created additional layers of MEOWs (MEOWs of the MEOWs, or Maximum Of The MEOWS called MOMs) eliminating consideration of hurricane direction but maintaining the separation of categories 1, through 5 storms. These MOMS were separated into normal forward speed storms (5 &15 mph) and fast (25 & 35 mph) hurricane forward speeds. The MOM inundation maps are shown on the supplied atlas printed separately. These inundation maps depict maximum storm surges that could be generated by the different storm intensities and forward speeds, without regard to direction, or track.

2.9 ADJUSTMENTS TO SLOSH MODEL VALUES

The surge height values contained in the MOMs represent the water surface elevations produced by the driving forces of the modeled hurricanes in combination with the 1.0-foot tide anomaly and a 2.5 – 4.0 foot high tide condition resulting in a 3.5 –5.0 foot water height at the onset of the storm.

2.10 TIME-HISTORY POINT DATA

The time-history information produced by the SLOSH model includes still-water surge heights, wind speeds, and wind direction at 30-minute intervals for 72 hours. Time history points were chosen to coincide with critical locations identified by county Emergency Management Directors for their respective jurisdictions. They are located at low-lying roads and bridges that would be critical to an evacuation, at potentially vulnerable population centers, or at significant natural or manmade barriers. Figures 2-4 through 2-22, at the end of this chapter, show the location of time history points for each coastal County. Tables 2-6 and 2-11 show the maximum surge heights for each time history point for the category 1 to the category 5 hurricane.

The purpose of the time-history data is to determine the pre-landfall hazard distances for each of the counties within the study area. Pre-landfall hazard distance is the distance

from the arrival of gale-force winds from an approaching hurricane to each jurisdiction at the time an evacuation would be curtailed by hazardous weather conditions. This distance must be accounted for in timing evacuation decision-making. For the South Carolina Hurricane Evacuation Restudy, two specific conditions were evaluated: the arrival of sustained gale-force winds (34-knot sustained wind speed, 1-minute average) and the onset of storm surge inundation of low-lying roads, bridges, or other critical areas. The first of these two conditions to occur determines the pre-landfall hazard distance.

The time of arrival of sustained tropical storm winds is one selected goal for completing an evacuation because high-profile vehicles and vehicles pulling campers or boats could easily be overturned, especially on high-rise bridges. Such an accident would most certainly cripple or halt traffic flow on that evacuation route. That arrival of sustained tropical force winds is also the time, under the majority of hurricane threats, when heavy rainfall begins. Generally, one-half of the total amount of rainfall received from a hurricane occurs from the arrival of sustained tropical storm winds until the eye reaches the coastline.

Storm surge inundation is the other condition limiting evacuation, but should not be a significant factor in most of the study area prior to the arrival of sustained tropical storm winds. The lowest roadway elevations in the study area should be considered when determining the pre-landfall hazard distance. As discussed in the section above, however, **evacuation decision-making officials should be aware that the coincidental occurrence of astronomical high tide and rising storm surge could cause moderate flooding in low-lying areas, particularly on bridge approaches, prior to the arrival of sustained tropical storm winds**.

Table 2-6. Wilmington/Myrtle Beach Basin Normal Forward Speed Storm Time History Point Surge Heights

Point No.	Point Name Description	Grid Cell** Ground Elevation	Normal Forward Speed Storms SURGE HEIGHTS ABOVE MSL BY STORM CATEGORY CAT1	CAT2	CAT3	CAT4	CAT5
	HORRY COUNTY						
71	LITTLE-RIVER INLET, NC/SC	-8	7	11	14	18	21
72	STATE LINE	-5	7	11	16	19	22
73	LITTLE RIVER	-4	8	12	17	20	23
74	COQUINA HARBOR	1	8	12	18	21	23
75	NIXON'S CROSSROADS	12	0	12	18	21	24
76	R.V. PARK	-5	7	11	15	18	22
77	TIDEWATER	3	7	11	15	19	22
78	CHERRY GROVE	-20	7	11	15	19	22
79	CRESCENT BEACH	-24	8	11	15	19	22
80	WINDY HILL	-27	8	12	16	19	23
81	DUNES SECTION	-26	8	12	16	19	23
82	OCEAN FOREST	-24	8	12	16	19	23
83	CONVENTION CENTER	-23	8	12	16	20	23
84	WITHERS WASH	-24	8	12	16	20	23
85	MYRTLE BEACH STATE PARK	-19	8	12	16	20	24
86	BUS RT. 17&SR 544 SURFSIDE BEACH	-22	8	12	17	21	24
87	GARDEN CITY BEACH	-23	8	13	17	21	24
88	WACCAMAW	8	0	0	0	0	10
89	SOCASTEE	7	0	0	0	0	13
90	BUCKSPORT	7	0	0	0	9	14
	GEORGETOWN COUNTY						
91	YAUHANNAH	6	0	0	6	6	6
92	WACCAWACHE MARINA	5	5	5	7	11	17
93	SANDY ISLAND	5	5	7	8	13	20
94	PEE DEE	5	5	7	9	13	20
95	WAVERLY MILLS	-22	7	10	13	16	21
96	BLACK RIVER	4	5	9	13	17	22
97	HAGLEY LANDING	21	6	10	14	18	22
98	GEORGETOWN	-10	8	12	16	20	24
99	BELLE ISLE GARDENS	-10	8	13	17	21	24
100	SAMPIT RIVER	16	8	0	0	0	19
101	MURRELLS INLET	3	9	13	17	21	25
102	HUNTINGTON BEACH STATE PARK	-19	8	12	17	21	24
103	LITCHFIELD BEACH	-26	8	12	17	20	24
104	PAWLEYS ISLAND	-24	8	13	17	21	24
105	DE BORDIEU	-15	8	13	17	21	24

Table 2-6. Wilmington/Myrtle Beach Basin Normal Forward Speed Storm Time History Point Surge Heights

Point No.	Point Name Description	Grid Cell** Ground Elevation	Normal Forward Speed Storms SURGE HEIGHTS ABOVE MSL BY STORM CATEGORY CAT1	CAT2	CAT3	CAT4	CAT5
106	BARUCH LAB	3	8	13	17	21	25
107	NORTH ISLAND LIGHT; WINYAH BAY	-7	8	12	16	19	23
108	SOUTH ISLAND	-14	8	11	15	18	21
109	NORTH SANTEE DELTA	-13	7	11	15	19	21
110	HOPSEEWEE	5	6	13	18	21	25

**This is the average ground elevation in the grid cell, specific site ground elevations will vary.

Table 2-7. Wilmington/Myrtle Beach Basin Fast Forward Speed Storm Time History Point Surge Heights

Point No.	Point Name Description	Grid Cell** Ground Elevation	Fast Forward Speed Storms SURGE HEIGHTS ABOVE MSL BY STORM CATEGORY CAT1	CAT2	CAT3	CAT4	CAT5
	HORRY COUNTY						
71	LITTLE-RIVER INLET, NC/SC	-8	10	16	20	25	30
72	STATE LINE	-5	8	15	22	27	32
73	LITTLE RIVER	-4	9	15	20	28	31
74	COQUINA HARBOR	1	9	16	22	26	31
75	NIXON'S CROSSROADS	12	0	16	22	27	30
76	R.V. PARK	-5	9	16	21	26	31
77	TIDEWATER	3	10	15	21	25	29
78	CHERRY GROVE	-20	10	15	21	25	29
79	CRESCENT BEACH	-24	10	16	20	25	29
80	WINDY HILL	-27	10	16	20	25	30
81	DUNES SECTION	-26	10	15	20	25	29
82	OCEAN FOREST	-24	10	15	20	25	29
83	CONVENTION CENTER	-23	10	15	20	24	28
84	WITHERS WASH	-24	10	15	20	24	28
85	MYRTLE BEACH STATE PARK	-19	10	15	20	24	28
86	BUS RT. 17&SR 544 SURFSIDE BEACH	-22	10	15	20	24	28
87	GARDEN CITY BEACH	-23	10	15	20	24	28
88	WACCAMAW	8	0	0	0	0	12
89	SOCASTEE	7	0	0	0	0	18
90	BUCKSPORT	7	0	0	0	7	17
	GEORGETOWN COUNTY						
91	YAUHANNAH	6	0	0	0	6	6
92	WACCAWACHE MARINA	5	4	5	7	11	17
93	SANDY ISLAND	5	4	6	9	13	20
94	PEE DEE	5	4	5	7	13	20
95	WAVERLY MILLS	-22	7	11	13	16	21
96	BLACK RIVER	4	4	8	11	18	22
97	HAGLEY LANDING	21	6	10	13	19	22
98	GEORGETOWN	-10	8	13	17	22	25
99	BELLE ISLE GARDENS	-10	8	13	18	22	26
100	SAMPIT RIVER	16	0	0	0	0	19
101	MURRELLS INLET	3	10	16	20	24	28
102	HUNTINGTON BEACH STATE PARK	-19	9	14	19	23	27
103	LITCHFIELD BEACH	-26	9	14	18	22	26
104	PAWLEYS ISLAND	-24	9	14	18	22	26
105	DE BORDIEU	-15	9	14	19	22	26
106	BARUCH LAB	3	9	14	18	22	26

Table 2-7. Wilmington/Myrtle Beach Basin Fast Forward Speed Storm Time History Point Surge Heights

Point No.	Point Name Description	Grid Cell** Ground Elevation	Fast Forward Speed Storms SURGE HEIGHTS ABOVE MSL BY STORM CATEGORY CAT1	CAT2	CAT3	CAT4	CAT5
107	NORTH ISLAND LIGHT; WINYAH BAY ENTR	-7	8	12	16	20	23
108	SOUTH ISLAND	-14	7	12	15	19	22
109	NORTH SANTEE DELTA	-13	8	12	16	19	23
110	HOPSEEWEE	5	9	15	19	23	26

**This is the average ground elevation in the grid cell, specific site ground elevations will vary.

Table 2-8. Charleston Basin Normal Speed Storm Time History Point Surge Heights

Point No.	Point Name Description	Grid Cell** Ground Elevation	Normal Forward Speed Storms SURGE HEIGHTS ABOVE MSL BY STORM CATEGORY CAT1	CAT2	CAT3	CAT4	CAT5
	COLLETON COUNTY						
1	COMBAHEE	-2	9	14	17	20	23
2	FIELDS POINT	-21	10	13	17	20	23
3	U. S. 17 AT ASHEPOO	-2	8	12	15	19	25
4	BEAR ISLAND	-20	8	13	16	19	22
5	BENNETTS POINT	-16	8	12	16	19	22
6	RAILROAD TRACK AT JACKSONBORO	-2	8	13	13	21	24
7	WEST BANK	-2	8	13	16	16	19
8	THE NECK	-9	8	11	14	17	20
9	THE MARINA.	-13	8	11	14	17	20
10	EDISTO BEACH	-7	8	11	14	17	20
11	PAVILLION	-12	8	11	14	17	20
12	EDISTO BEACH STATE PARK	-10	8	11	14	17	20
13	EDENVILLE BEACH	-9	8	11	14	17	20
14	DAWHO BRIDGE	-8	7	11	15	18	21
	CHARLESTON COUNTY						
15	SEABROOK	-39	8	11	14	17	19
16	HWY 174 AT TOOGOODOO CREEK	0	8	11	12	15	22
17	MEGGETT	0	8	12	16	18	21
18	WADMALAW ISLAND	6	7	10	14	17	19
19	ROCKVILLE	-17	7	11	14	17	19
20	SEABROOK ISLAND ROAD	13	7	11	14	17	19
21	BOHICKET RIVER ROAD	10	0	10	14	17	19
22	CEDAR SPRINGS	-6	7	10	14	16	20

Table 2-8. Charleston Basin Normal Speed Storm Time History Point Surge Heights

Point No.	Point Name Description	Grid Cell** Ground Elevation	Normal Forward Speed Storms SURGE HEIGHTS ABOVE MSL BY STORM CATEGORY CAT1	CAT2	CAT3	CAT4	CAT5
23	CHURCH CREEK	-4	7	10	14	16	20
24	KIAWAH ISLAND PARKWAY	5	7	11	14	17	20
25	KIAWAH ISLAND	-8	7	11	14	17	19
26	U.S.17 AT RANTOWLES CREEK	-2	8	11	15	18	21
27	LIMEHOUSE BRIDGE	-8	8	11	15	18	21
28	S STONO RIVER' PARKDALE	-8	8	11	15	18	21
29	STONO RIVER BRIDGE	-18	8	11	15	18	21
30	STONO INLET	-21	7	11	14	17	19
31	SOL LEGARE	3	7	11	14	17	20
32	FOLLY RIVER.	-14	7	11	14	17	19
33	FOLLY BEACH	-14	7	10	13	16	19
34	LIGHTHOUSE INLET	-22	7	11	14	16	19
35	JAMES ISLAND	11	0	12	15	19	22
36	FORT SUMTER	-10	8	11	15	18	21
37	PORT JOHNSON	-6	8	12	15	18	21
38	WAPPOO CUT	-15	9	12	15	19	22
39	BRIDGEVIEW	-11	10	14	19	22	24
40	NORTH BRIDGE	-1	9	13	17	20	22
41	HAMPTON PARK	-3	9	13	16	19	22
42	COAST GUARD BASE	-24	8	12	15	19	22
43	WHITE POINT GARDEN	9	8	12	15	19	22
44	TIDE GAUGE	-30	8	12	15	19	22
45	DANIEL ISLAND	-8	8	11	14	17	20
46	CHARLESTON NECK	-36	8	11	14	18	20
47	NAVAL BASE	-31	8	11	14	17	20
48	NORTH CHARLESTON	-37	7	10	13	16	20
49	GOOSE CREEK	-39	7	10	13	16	19
50	HANAHAN	-3	8	10	13	15	20
51	RED BANK	-26	9	10	13	15	18
52	PARADISE ISLAND	-5	8	11	13	16	19
53	WANDO RIVER BRIDGE	-16	8	10	13	15	19
54	CAINHOY	-8	8	11	14	16	19
55	HOBCAW POINT	-9	8	12	16	19	21
56	SHEM CREEK	-6	8	12	15	19	21
57	MOUNT PLEASANT	-6	8	11	15	18	21
58	BEN SAWYER	-3	8	12	15	18	21
59	SULLIVANS ISLAND	-9	8	11	14	17	20
60	BREACH INLET	-8	7	11	14	17	20
61	ISLE OF PALMS	-10	7	11	14	17	19

Table 2-8. Charleston Basin Normal Speed Storm Time History Point Surge Heights

Point No.	Point Name Description	Grid Cell** Ground Elevation	Normal Forward Speed Storms SURGE HEIGHTS ABOVE MSL BY STORM CATEGORY CAT1	CAT2	CAT3	CAT4	CAT5
62	DEWEES ISLAND	-17	7	11	14	18	20
63	COPAHEE	-2	8	12	15	19	21
64	WHITEHALL.	4	8	12	15	19	21
65	MOORES LANDING	-3	8	12	15	19	22
66	ROMAIN RETREAT	-6	8	12	16	19	22
67	AWENDAW	17	0	0	0	20	22
68	BUCKHALL LANDING	-12	8	12	16	19	22
69	MC CLELLANVILLE	-10	8	13	17	21	27
70	U.S. 17 AT SOUTH SANTEE RIVER	-6	6	13	18	21	25

**This is the average ground elevation in the grid cell, specific site ground elevations will vary.

Table 2-9. Charleston Basin Fast Speed Storm Time History Point Surge Heights

Point No.	Point Name Description	Grid Cell** Ground Elevation	Fast Forward Speed Storms SURGE HEIGHTS ABOVE MSL BY STORM CATEGORY CAT1	CAT2	CAT3	CAT4	CAT5
	COLLETON COUNTY						
1	COMBAHEE	-2	9	13	17	20	22
2	FIELDS POINT	-21	10	14	17	22	25
3	U. S. 17 AT ASHEPOO	-2	7	11	19	22	23
4	BEAR ISLAND	-20	9	13	18	22	25
5	BENNETTS POINT	-16	10	13	18	21	25
6	RAILROAD TRACK AT JACKSONBORO	-2	8	13	17	22	25
7	WEST BANK	-2	8	11	17	22	25
8	THE NECK	-9	10	15	19	22	26
9	THE MARINA.	-13	10	14	19	19	26
10	EDISTO BEACH	-7	10	14	18	19	25
11	PAVILLION	-12	10	14	19	19	25
12	EDISTO BEACH STATE PARK	-10	10	14	19	19	26
13	EDENVILLE BEACH	-9	9	13	18	19	26
14	DAWHO BRIDGE	-8	9	13	19	22	28
	CHARLESTON COUNTY						
15	SEABROOK	-39	9	13	19	19	22
16	HWY 174 AT TOOGOODOO CREEK	0	7	11	12	23	29
17	MEGGETT	0	8	13	18	22	26
18	WADMALAW ISLAND	6	8	13	19	22	23
19	ROCKVILLE	-17	8	15	19	20	23
20	SEABROOK ISLAND ROAD	13	9	15	19	21	23
21	BOHICKET RIVER ROAD	10	0	14	19	21	25
22	CEDAR SPRINGS	-6	8	12	15	22	26
23	CHURCH CREEK	-4	8	13	16	22	25
24	KIAWAH ISLAND PARKWAY	5	9	14	19	21	23
25	KIAWAH ISLAND	-8	9	13	19	20	23
26	U.S.17 AT RANTOWLES CREEK	-2	8	12	16	20	24
27	LIMEHOUSE BRIDGE	-8	8	12	16	20	25
28	S STONO RIVER' PARKDALE	-8	8	13	18	22	25
29	STONO RIVER BRIDGE	-18	8	13	17	21	25
30	STONO INLET	-21	9	13	17	20	23
31	SOL LEGARE	3	9	13	17	20	23
32	FOLLY RIVER.	-14	9	13	16	19	22
33	FOLLY BEACH	-14	8	12	16	18	21
34	LIGHTHOUSE INLET	-22	8	12	15	18	21
35	JAMES ISLAND	11	0	13	17	20	24
36	FORT SUMTER	-10	9	13	17	20	23

Table 2-9. Charleston Basin Fast Speed Storm Time History Point Surge Heights

Point No.	Point Name Description	Grid Cell** Ground Elevation	Fast Forward Speed Storms SURGE HEIGHTS ABOVE MSL BY STORM CATEGORY CAT1	CAT2	CAT3	CAT4	CAT5
37	PORT JOHNSON	-6	9	13	17	20	23
38	WAPPOO CUT	-15	9	13	17	21	25
39	BRIDGEVIEW	-11	11	15	19	22	24
40	NORTH BRIDGE	-1	10	15	18	22	24
41	HAMPTON PARK	-3	10	14	18	21	25
42	COAST GUARD BASE	-24	9	14	17	21	25
43	WHITE POINT GARDEN	9	9	14	17	21	25
44	TIDE GAUGE	-30	9	13	17	21	25
45	DANIEL ISLAND	-8	9	11	15	19	23
46	CHARLESTON NECK	-36	9	12	15	20	23
47	NAVAL BASE	-31	8	11	15	18	22
48	NORTH CHARLESTON	-37	8	11	14	17	22
49	GOOSE CREEK	-39	8	10	13	17	22
50	HANAHAN	-3	8	10	12	18	23
51	RED BANK	-26	7	9	12	14	18
52	PARADISE ISLAND	-5	8	11	14	17	21
53	WANDO RIVER BRIDGE	-16	8	11	14	16	22
54	CAINHOY	-8	8	11	15	18	23
55	HOBCAW POINT	-9	9	13	17	22	25
56	SHEM CREEK	-6	9	14	17	21	24
57	MOUNT PLEASANT	-6	9	14	17	21	24
58	BEN SAWYER	-3	9	14	18	22	24
59	SULLIVANS ISLAND	-9	9	13	17	20	23
60	BREACH INLET	-8	9	13	17	20	23
61	ISLE OF PALMS	-10	8	13	17	20	23
62	DEWEES ISLAND	-17	9	14	18	21	24
63	COPAHEE	-2	9	15	19	23	25
64	WHITEHALL.	4	9	15	19	23	25
65	MOORES LANDING	-3	10	15	20	23	26
66	ROMAIN RETREAT	-6	10	15	20	24	26
67	AWENDAW	17	0	0	20	23	27
68	BUCKHALL LANDING	-12	10	16	20	23	27
69	MC CLELLANVILLE	-10	10	15	19	23	26
70	U.S. 17 AT SOUTH SANTEE RIVER	-6	10	15	19	23	26

**This is the average ground elevation in the grid cell, specific site ground elevations will vary.

Table 2-10. Savannah/Hilton Head Basin Normal Speed Storm Time History Point Surge Heights

Point No.	Point Name Description	Grid Cell** Ground Elevation	Normal Forward Speed Storms SURGE HEIGHTS ABOVE MSL BY STORM CATEGORY CAT1	CAT2	CAT3	CAT4	CAT5
	JASPER COUNTY						
1	PURYSBURG	-2	7	11	17	22	25
2	US 17 Q US 17A	4	7	11	16	19	23
3	LIME HOUSE	15	0	0	15	19	22
4	PRITCHARD STATION	4	7	11	14	17	21
5	SUN CITY	9	0	0	14	16	21
6	US 278 @ HAZZARD CREEK	9	0	14	17	21	24
7	EUHAW CREEK	-1	10	14	18	21	24
8	SC 462 @ SC 19	8	9	14	19	21	24
9	SC 462 @ BEES CREEK	3	10	15	18	21	24
10	COOSAWHATCHEE	-1	10	15	18	22	25
	BEAUFORT COUNTY						
11	TULIFINY	2	9	14	19	22	24
12	POCOTALIGO	16	0	0	18	20	23
13	POCOTALIGO CREEK	-5	10	15	19	21	24
14	SALKEHATCHIE	12	0	14	16	19	23
15	SUGAR HILL	-4	8	14	17	20	23
16	COMBAHEE RIVER	-4	9	14	17	20	23
17	GARDENS, CORNER	12	0	12	17	20	23
18	LOBECO	-5	9	13	18	21	23
19	DALE	-5	10	13	18	21	23
20	KEAN NECK	9	10	13	17	20	23
21	WIMBEE CREEK / DALE EAST	4	9	13	17	20	23
22	FIELDS POINT	-8	10	13	17	20	23
23	BRICKYARD	4	8	13	16	19	22
24	COOSAW POINT	3	8	12	16	19	22
25	WILLTOWN	4	8	13	17	20	23
26	DAWHO, NORTH	-8	8	12	16	19	21
27	FENWICK	-8	8	12	16	19	21
28	SAINT PIERRE CREEK	-13	8	11	14	17	20
29	EDISTO BEACH	-10	8	11	14	17	20
30	HAZZARD CREEK	-6	10	14	18	21	24
31	OKATEE BRANCH	-1	10	15	18	21	23
32	OKATEE RIVER	-5	10	14	19	21	23
33	COLLETON	-13	10	14	18	21	23
34	BROAD RIVER/ E.B.RODGERS BRIDGE	-28	9	13	17	20	23
35	BATTERY CREEK	5	7	11	15	20	23
36	ALBERGOTTI CREEK	-10	9	13	17	21	23
37	OLD POINT	-10	8	12	16	19	22
38	BEAUFORT	-10	8	12	16	19	22
39	PORT ROYAL	-12	8	12	16	19	22
40	CHOWAN CREEK	4	8	12	16	19	22
41	PARRIS ISLAND	-18	8	12	16	19	22
42	WARSAW SLATS	-2	9	12	16	19	22

Table 2-10. Savannah/Hilton Head Basin Normal Speed Storm Time History Point Surge Heights

Point No.	Point Name Description	Grid Cell** Ground Elevation	Normal Forward Speed Storms SURGE HEIGHTS ABOVE MSL BY STORM CATEGORY CAT1	CAT2	CAT3	CAT4	CAT5
43	DATHA ISLAND	-12	9	12	16	19	22
44	HARBOR RIVER	-2	9	13	16	19	22
45	HARBOR ISLAND	-10	9	12	15	18	21
46	FRIPP ISLAND	-8	8	12	15	18	20
47	STATION CREEK	3	9	13	16	19	22
48	FISH HAUL	-30	9	12	15	18	21
49	ROSEDHU	4	9	15	18	20	24
50	BLUFFTON	-5	9	13	17	20	23
51	MACKAY CREEK	-10	9	13	16	20	23
52	SKULL CREEK	-8	9	13	16	19	22
53	OLD HS CREEK	-17	9	13	16	19	22
54	PALMETTO BAY	-12	9	13	16	19	22
55	JARVIS CREEK	4	8	13	16	19	22
56	BROAD CREEK	0	8	13	16	19	22
57	FOLLY FIELD	-6	9	13	16	19	22
58	COLONGY/FOREST BEACH	-11	9	12	16	19	22
59	SEA PINES	-35	9	13	16	20	23
60	COOPER RIVER	-4	9	13	17	20	23
61	NEW RIVER	2	9	13	17	20	23

**This is the average ground elevation in the grid cell, specific site ground elevations will vary.

Table 2-11. Savannah/Hilton Head Basin Fast Speed Storm Time History Point Surge Heights

Point No.	Point Name Description	Grid Cell** Ground Elevation	Fast Forward Speed Storms SURGE HEIGHTS ABOVE MSL BY STORM CATEGORY CAT1	CAT2	CAT3	CAT4	CAT5
	JASPER COUNTY						
1	PURYSBURG	-2	6	11	17	22	27
2	US 17 Q US 17A	4	7	12	17	21	26
3	LIME HOUSE	15	0	0	17	24	27
4	PRITCHARD STATION	4	6	13	17	23	27
5	SUN CITY	9	0	9	15	20	24
6	US 278 @ HAZZARD CREEK	9	0	15	19	22	25
7	EUHAW CREEK	-1	10	15	19	23	26
8	SC 462 @ SC 19	8	10	16	20	23	26
9	SC 462 @ BEES CREEK	3	10	16	20	23	25
10	COOSAWHATCHEE	-1	10	16	20	23	26
	BEAUFORT COUNTY						
11	TULIFINY	2	10	17	22	24	27
12	POCOTALIGO	16	0	0	20	22	24
13	POCOTALIGO CREEK	-5	10	15	20	24	27

Table 2-11. Savannah/Hilton Head Basin Fast Speed Storm Time History Point Surge Heights

Point No.	Point Name Description	Grid Cell** Ground Elevation	Fast Forward Speed Storms SURGE HEIGHTS ABOVE MSL BY STORM CATEGORY CAT1	CAT2	CAT3	CAT4	CAT5
14	SALKEHATCHIE	12	8	12	15	19	22
15	SUGAR HILL	-4	8	13	17	21	22
16	COMBAHEE RIVER	-4	9	13	17	20	22
17	GARDENS, CORNER	12	10	12	18	22	27
18	LOBECO	-5	10	14	18	23	27
19	DALE	-5	10	13	18	22	26
20	KEAN NECK	9	10	13	17	21	23
21	WIMBEE CREEK / DALE EAST	4	10	13	17	21	25
22	FIELDS POINT	-8	10	14	17	22	25
23	BRICKYARD	4	9	13	18	22	25
24	COOSAW POINT	3	10	13	18	21	25
25	WILLTOWN	4	8	13	18	21	25
26	DAWHO, NORTH	-8	9	13	19	23	27
27	FENWICK	-8	9	13	18	22	26
28	SAINT PIERRE CREEK	-13	10	15	19	22	26
29	EDISTO BEACH	-10	10	14	18	21	25
30	HAZZARD CREEK	-6	11	15	19	23	26
31	OKATEE BRANCH	-1	11	15	20	22	26
32	OKATEE RIVER	-5	10	15	20	23	26
33	COLLETON	-13	10	14	19	22	25
34	BROAD RIVER/ E.B.RODGERS BRIDGE	-28	11	15	19	23	27
35	BATTERY CREEK	5	7	11	19	24	28
36	ALBERGOTTI CREEK	-10	9	13	18	21	25
37	OLD POINT	-10	8	13	19	23	27
38	BEAUFORT	-10	8	13	19	24	28
39	PORT ROYAL	-12	9	14	19	24	27
40	CHOWAN CREEK	4	9	14	19	23	27
41	PARRIS ISLAND	-18	10	15	19	23	27
42	WARSAW SLATS	-2	9	13	18	23	28
43	DATHA ISLAND	-12	9	13	17	22	26
44	HARBOR RIVER	-2	11	17	21	25	28
45	HARBOR ISLAND	-10	10	15	18	22	25
46	FRIPP ISLAND	-8	10	15	19	23	26
47	STATION CREEK	3	11	16	20	23	27
48	FISH HAUL	-30	10	14	18	22	26
49	ROSEDHU	4	9	16	22	27	32
50	BLUFFTON	-5	9	17	23	27	31
51	MACKAY CREEK	-10	10	16	21	25	29
52	SKULL CREEK	-8	10	16	20	24	27
53	OLD HS CREEK	-17	10	15	20	25	29
54	PALMETTO BAY	-12	10	15	20	25	29
55	JARVIS CREEK	4	10	16	20	25	28
56	BROAD CREEK	0	10	16	20	23	27
57	FOLLY FIELD	-6	11	15	19	22	26
58	COLONGY/FOREST BEACH	-11	11	16	20	24	27

Table 2-11. Savannah/Hilton Head Basin Fast Speed Storm Time History Point Surge Heights

Point No.	Point Name Description	Grid Cell** Ground Elevation	Fast Forward Speed Storms SURGE HEIGHTS ABOVE MSL BY STORM CATEGORY CAT1	CAT2	CAT3	CAT4	CAT5
59	SEA PINES	-35	12	16	20	24	28
60	COOPER RIVER	-4	11	16	21	25	29
61	NEW RIVER	2	11	16	21	25	29

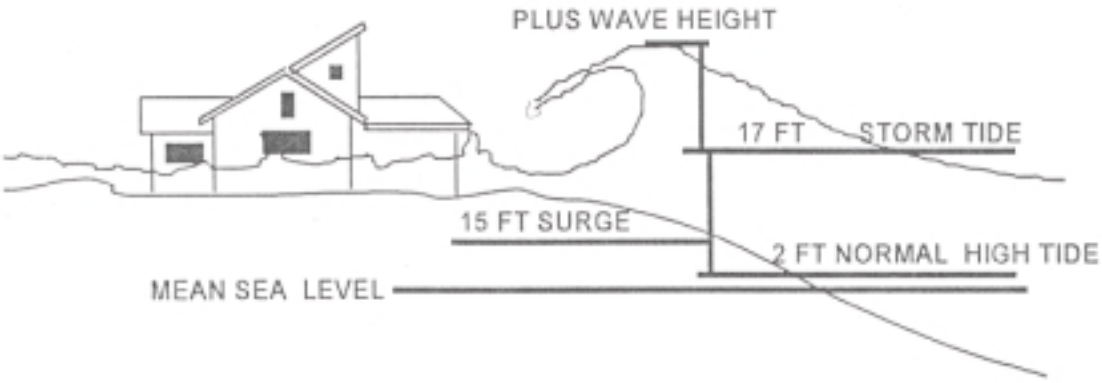
**This is the average ground elevation in the grid cell, specific site ground elevations will vary.

2.11 TROPICAL CYCLONE ADVISORY

Tropical cyclone advisories, produced by the National Hurricane Center every 6 hours, give the measured distance in nautical miles of the 34-knot (approximately 40 miles per hour), 1-minute sustained wind speed (tropical storm) from the eye of an approaching hurricane. These distances are given for the four quadrants of the storm (i.e., northwest, northeast, southeast, southwest). Forecasts of these distances for 12, 24, 36, 48, and 72 hours into the future are also given. The largest radius listed should be used for the pre-landfall hazard distance in evacuation decision-making. Further discussion of the application of the radius of tropical storm winds to hurricane evacuation decision-making is contained in Chapter 7, Decision Arcs.

2.12 WAVE EFFECT

The SLOSH model does not provide data concerning the height of waves generated by the wave effect in addition to the still-water storm surge height. Generally, waves do not add significantly to the area flooded and have little effect on the number of people that will be required to evacuate. Since near-shore wave phenomena under hurricane conditions are not well understood, it is assumed that for the open coast, maximum theoretical wave heights based upon relationships of fetch length to water depth occur near the time of landfall. Immediately along the coastline or the shorelines of very large sounds and estuaries, wave crests can increase the expected still-water depth above the



terrain by one-third, thus greatly increasing the hazard. Due to the presence of barriers such as structures, dunes, or vegetation, the waves break and dissipate a tremendous amount of energy within a few hundred yards of the coastline. Buildings within that zone

that are not specifically designed to withstand the forces of wave action are often heavily damaged or destroyed.

For evacuation planning purposes, it is perhaps more important to consider potential wave effects for less than sustained tropical storm winds. If wave heights above theoretical still-water levels exceed the elevations of roads, bridges, or other critical areas near the coastline, evacuation could be curtailed sooner than expected, increasing the pre-landfall hazards distance. Evacuation planners should be aware that low-lying sections of highway could be subject to some wave action and overwash prior to the arrival of sustained tropical storm winds, especially with the coincidental occurrence of astronomical high tide.

2.13 HURRICANE WINDS

After hurricane Hugo in South Carolina and Andrew in south Florida it became apparent that storm surge was not the only life-threatening feature of hurricanes. Destructive hurricane force winds and tornadoes effected many inland counties as far as 100 miles from the coast. Studies by the National Hurricane Center (NHC) have resulted in modifying the Tropical Cyclone Advisory to include additional information to help inland counties prepare for threatening high wind conditions. An inland wind computer model prepared in connection with the HURREVAC computer program has been completed and is called "HURREVAC and Inland Winds For Windows95 /NT." The computer program is a hurricane decision assistance and planning tool designed for emergency management by FEMA and USACE. It has been provided to both state and county emergency management officials to be used ONLY in the LAST HOURS before storm landfall, when the NHC track and windfield forecast errors are relatively low. For more information on HURREVAC, please refer to Chapter 7- Decision Tools.

2.14 FRESHWATER FLOODING

Amounts and arrival times of rainfall associated with hurricanes are highly unpredictable. For most hurricanes, rainfall begins near the time of arrival of sustained tropical storm winds and generally reaches maximum rainfall rates as the center passes by. Unrelated weather systems in advance of the hurricane can also contribute significant rainfall amounts within a basin.

Due to the unpredictability of rainfall from hurricanes, no attempt was made to employ sophisticated modeling or analysis in quantifying those effects for the study area.

Locations and facilities which are in the 100-year floodplain boundaries shown on the National Flood Insurance Rate Maps for the counties or have historically flooded during periods of heavy rainfall should be considered to be vulnerable to freshwater flooding from hurricane conditions. FEMA Flood Insurance data, which depicts 100-year flood plain boundaries, are shown on the storm surge atlas printed separately. This data named FEMA Special Flood Hazard Area (SFHA) is representative of zones A, AE and VE as depicted on FEMA Flood Insurance Rate Maps. Where available, FEMA's National Flood Insurance Program digital Q3 Flood Data was used for this study. FEMA Q3 data of the 100-year floodplain boundaries for the counties of Dorchester and Hampton were not available at the time of map development. The boundaries delineated for these counties was digitized by USACE directly from county Flood Insurance Rate Maps (FIRMS).

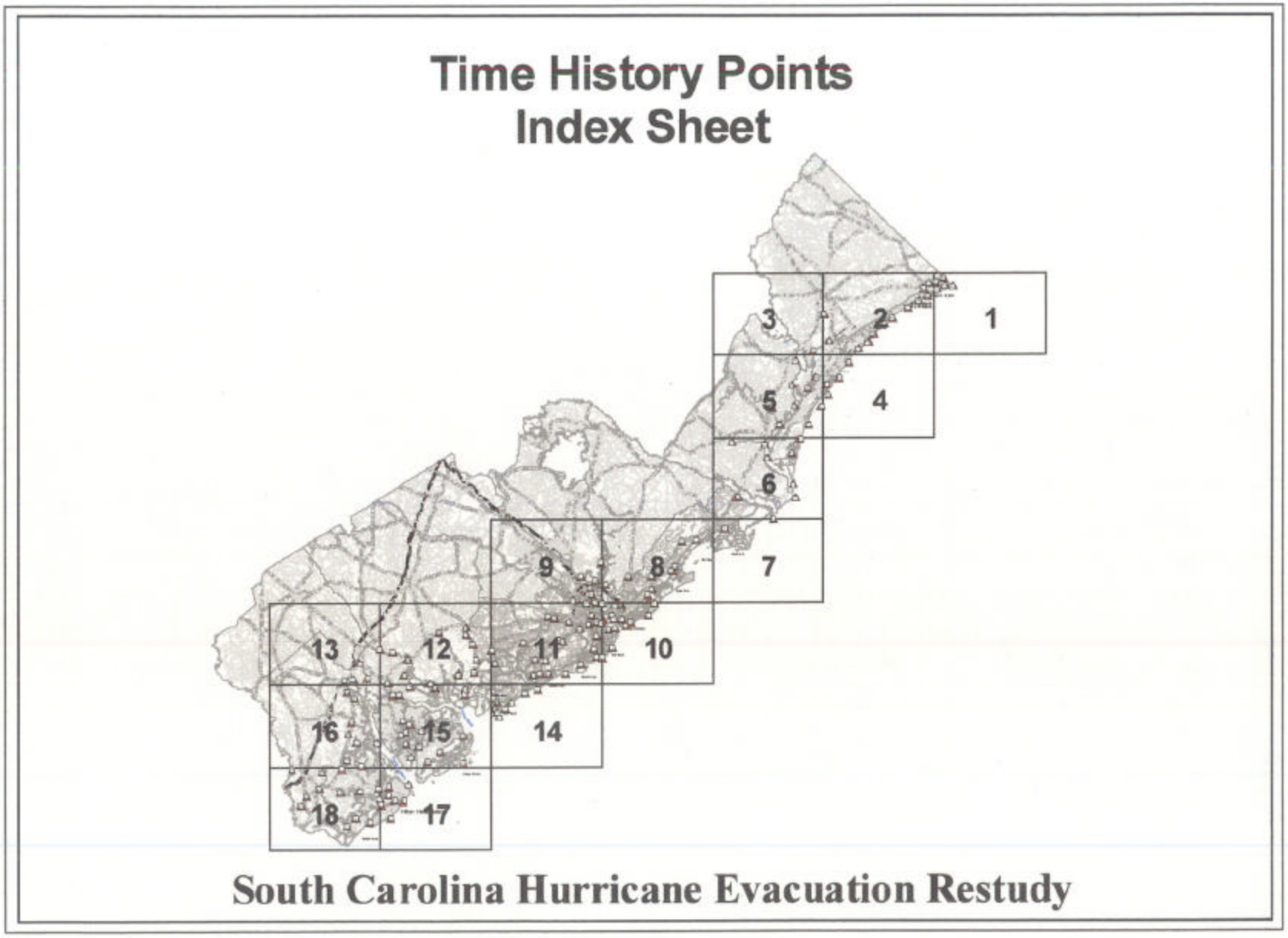


Figure 2-4 SLOSH Model Time History Point Index Sheet

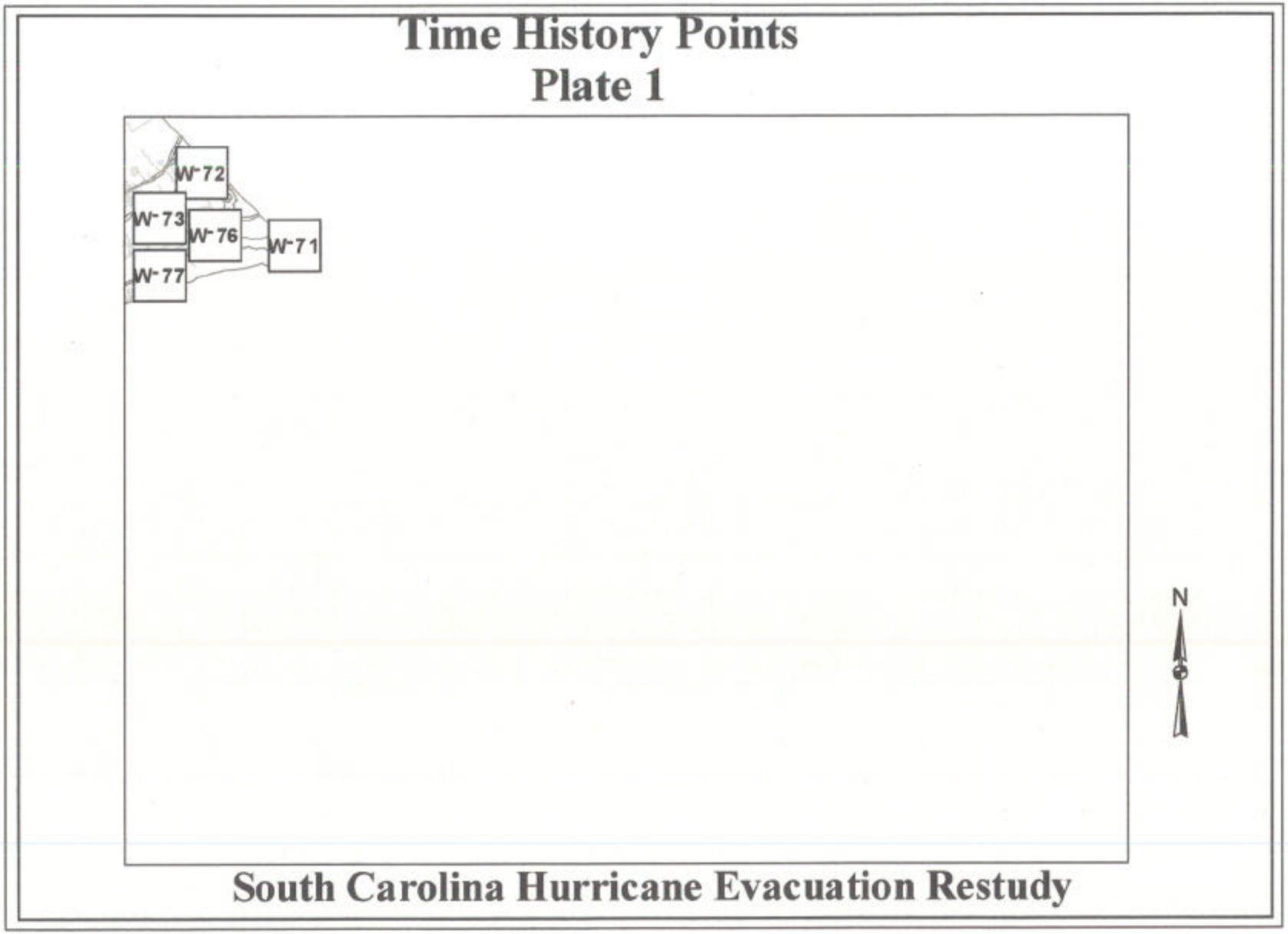
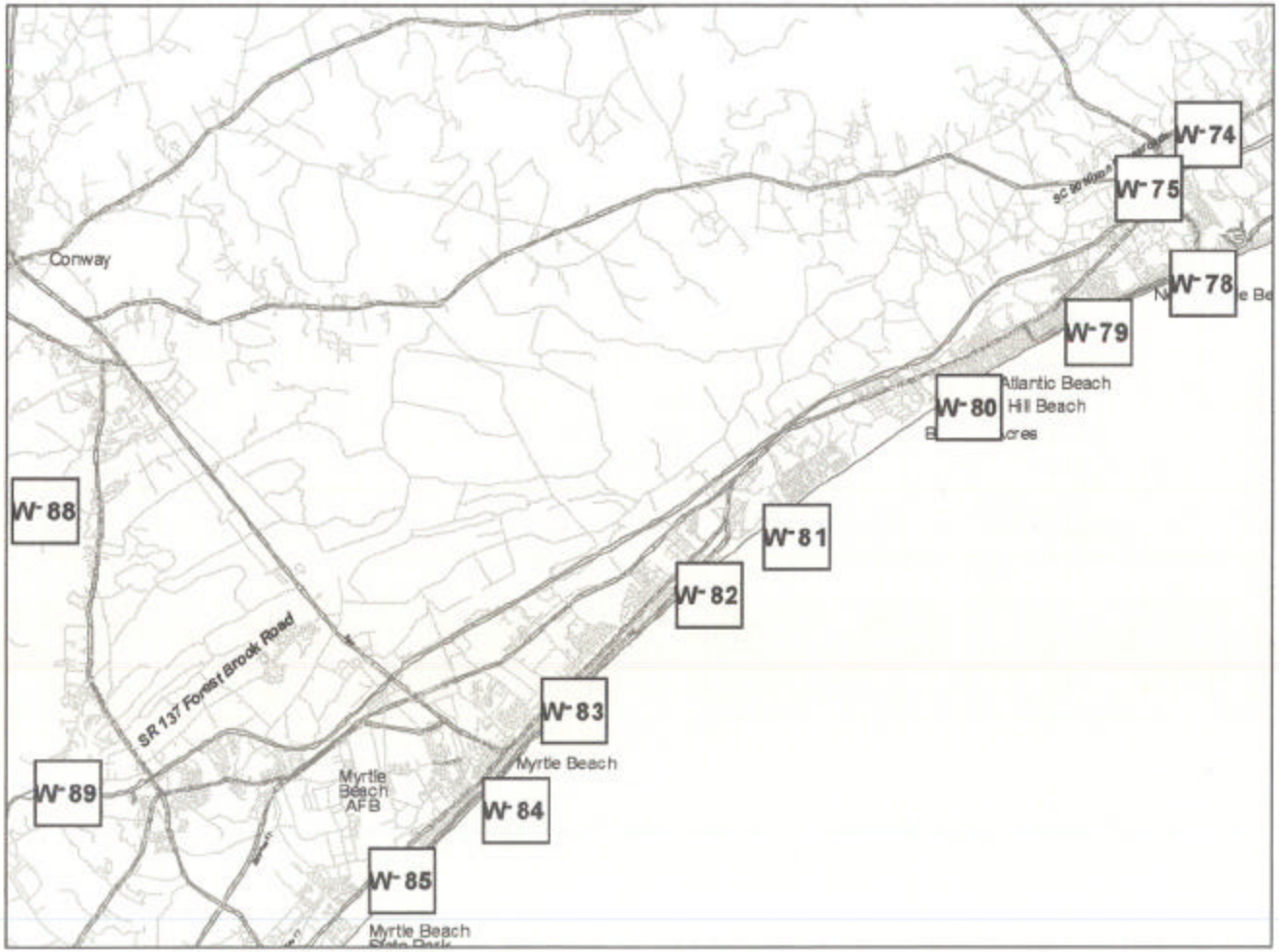


Figure 2-5 Time History Points Plate 1

Time History Points
Plate 2



South Carolina Hurricane Evacuation Restudy

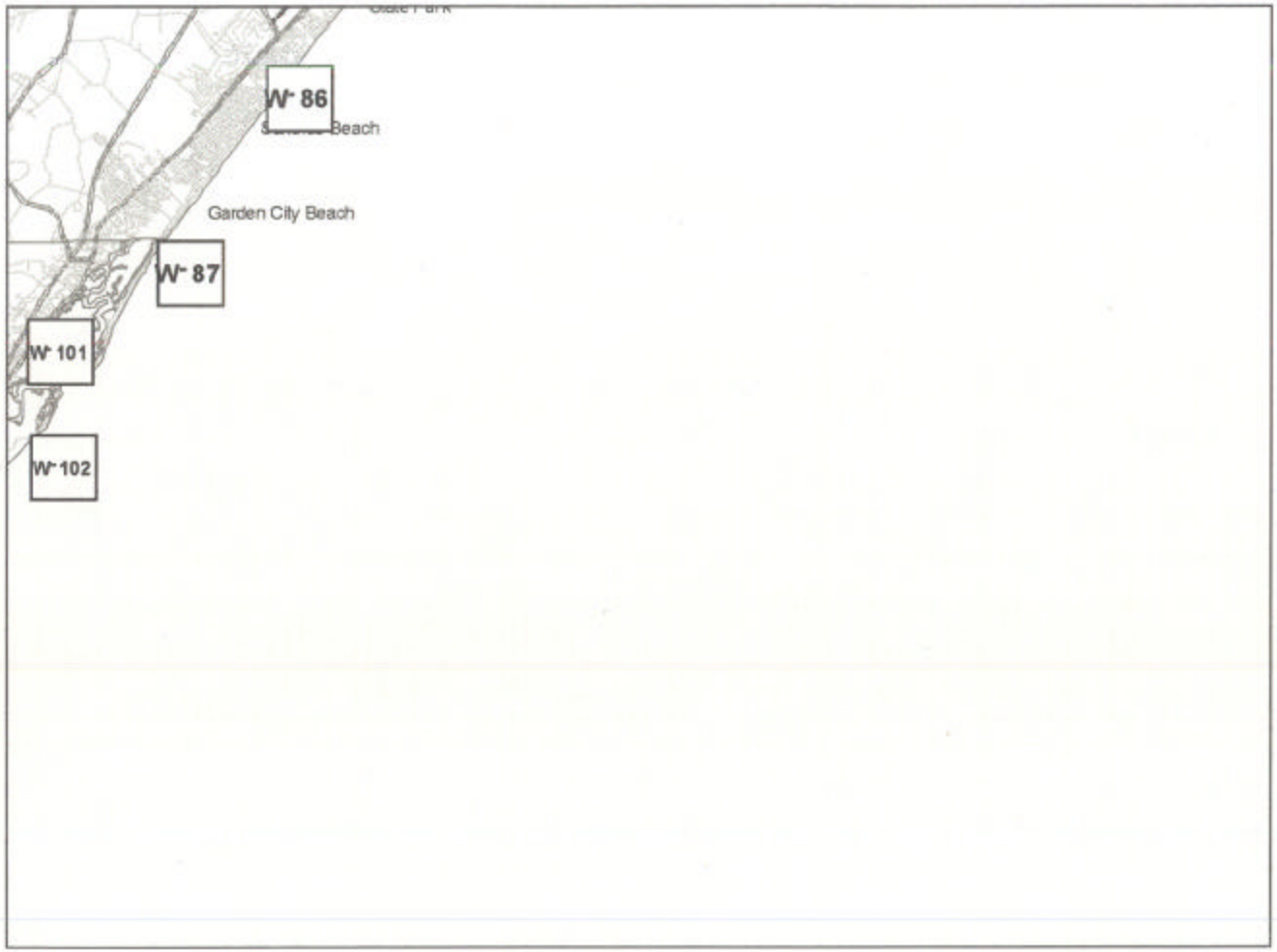
Figure 2-6 Time History Points Plate 2

Time History Points
Plate 3

South Carolina Hurricane Evacuation Restudy

Figure 2-7 Time History Points Plate 3

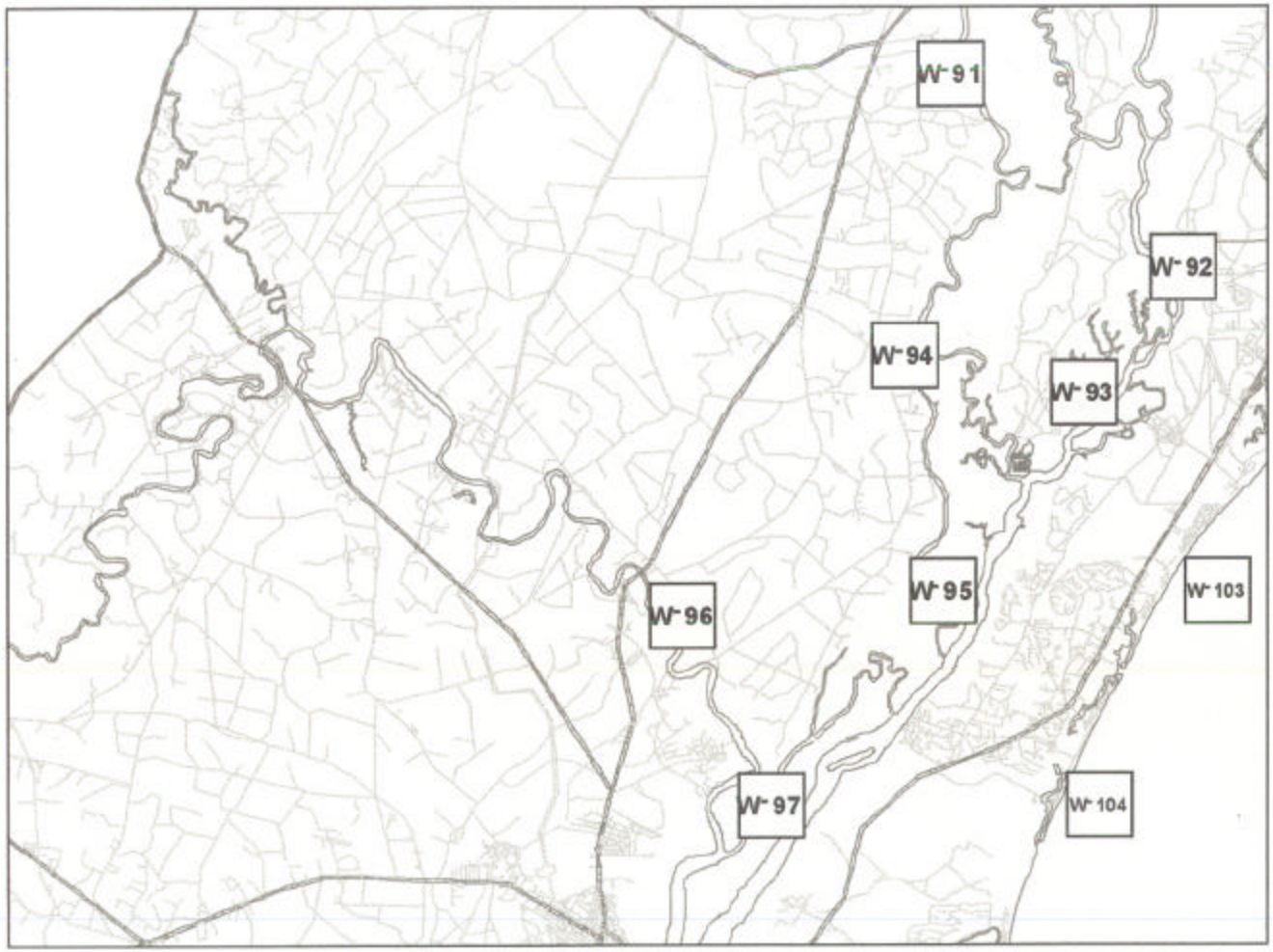
Time History Points
Plate 4



South Carolina Hurricane Evacuation Restudy

Figure 2-8 Time History Points Plate 4

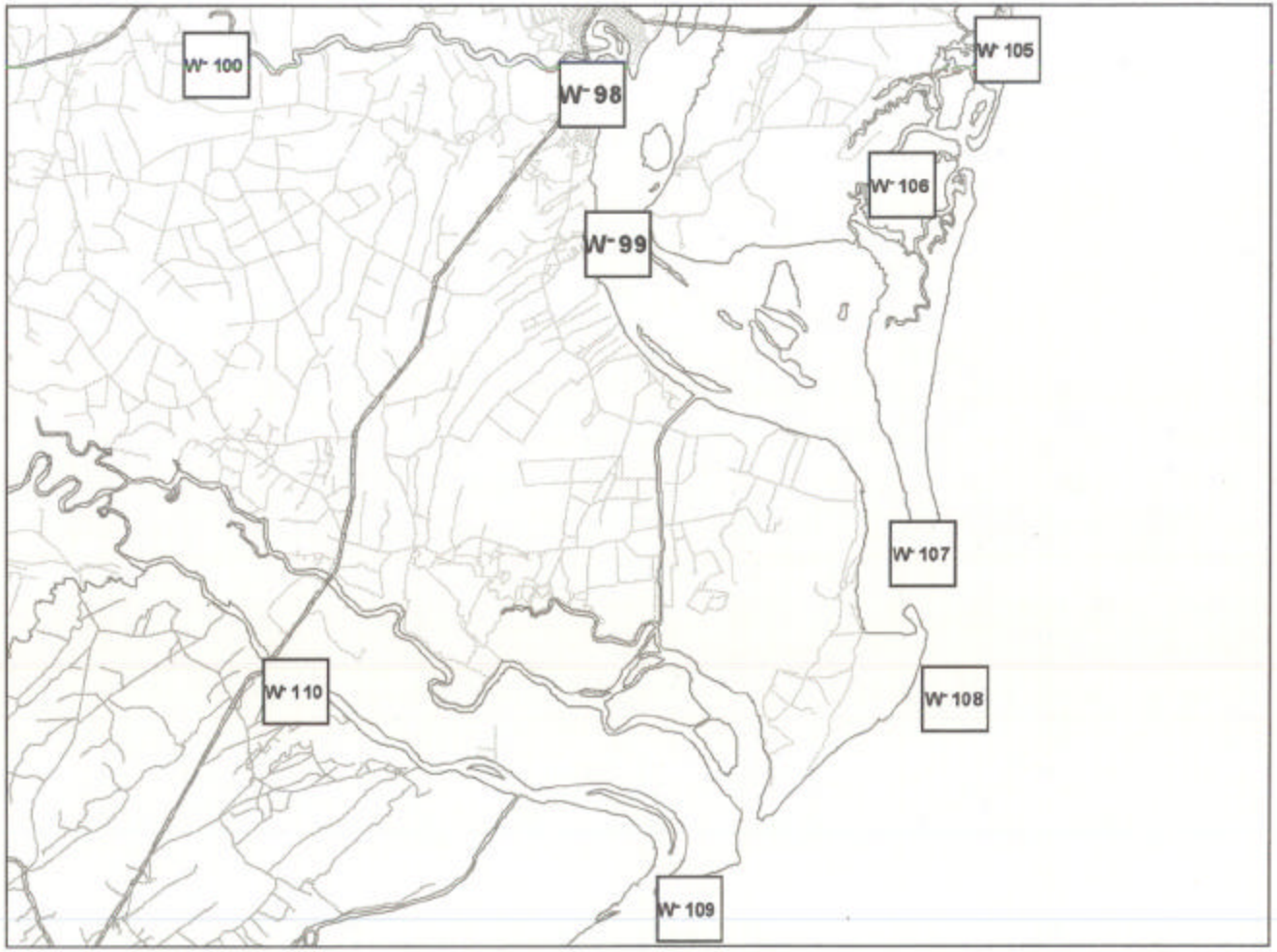
Time History Points
Plate 5



South Carolina Hurricane Evacuation Restudy

Figure 2-9 Time History Points Plate 5

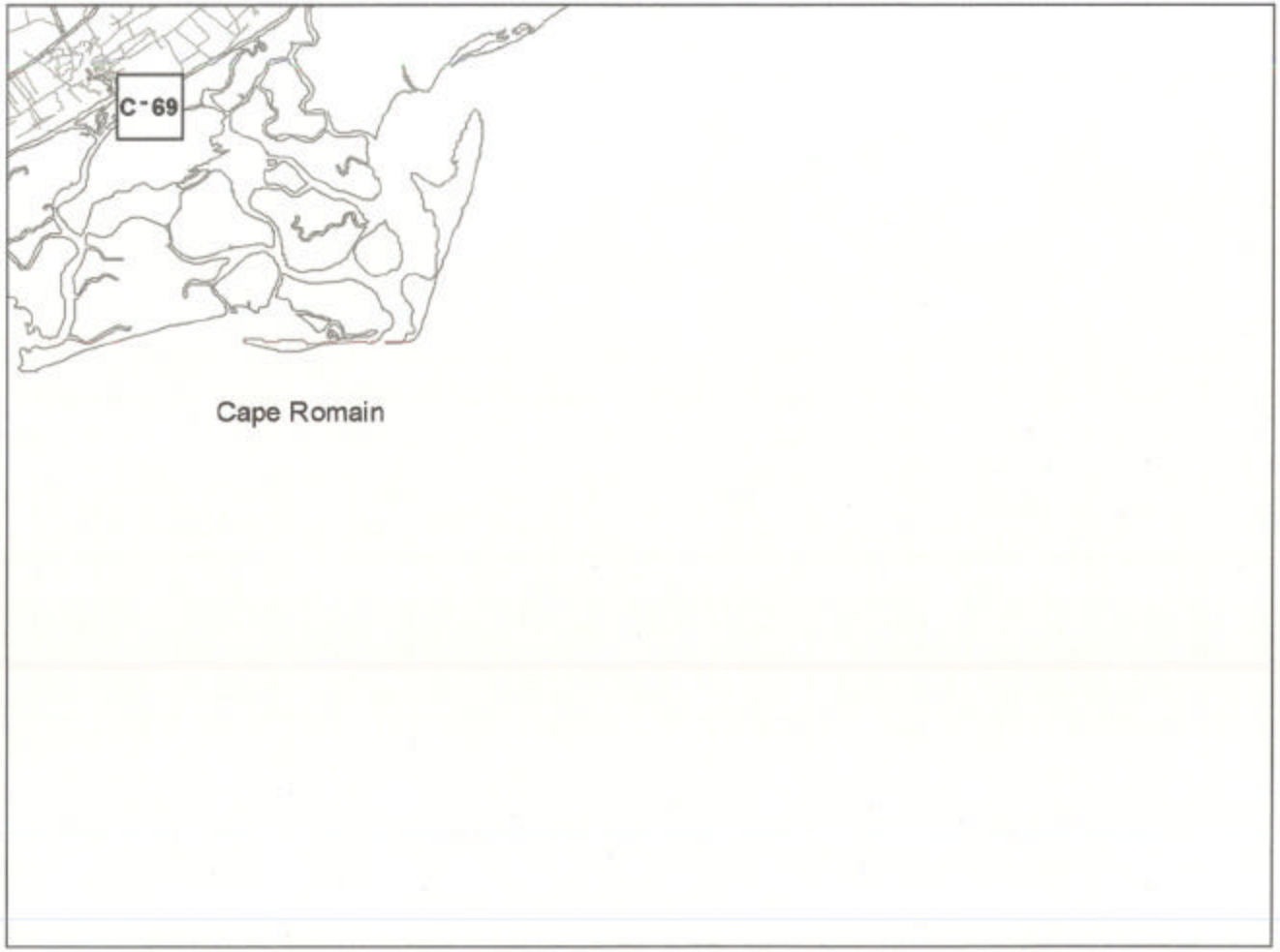
Time History Points
Plate 6



South Carolina Hurricane Evacuation Restudy

Figure 2-10 Time History Points Plate 6

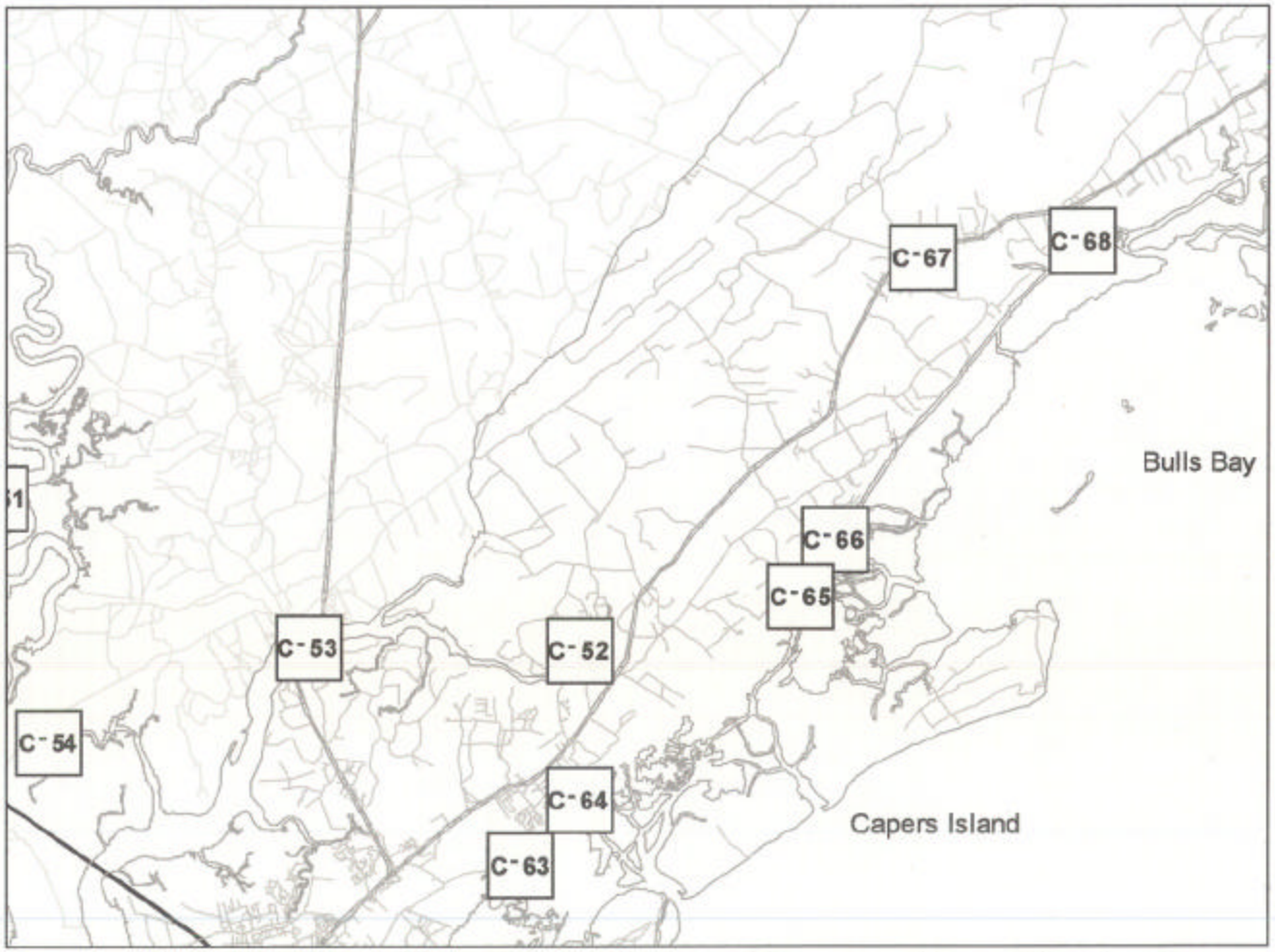
Time History Points
Plate 7



South Carolina Hurricane Evacuation Restudy

Figure 2-11 Time History Points Plate 7

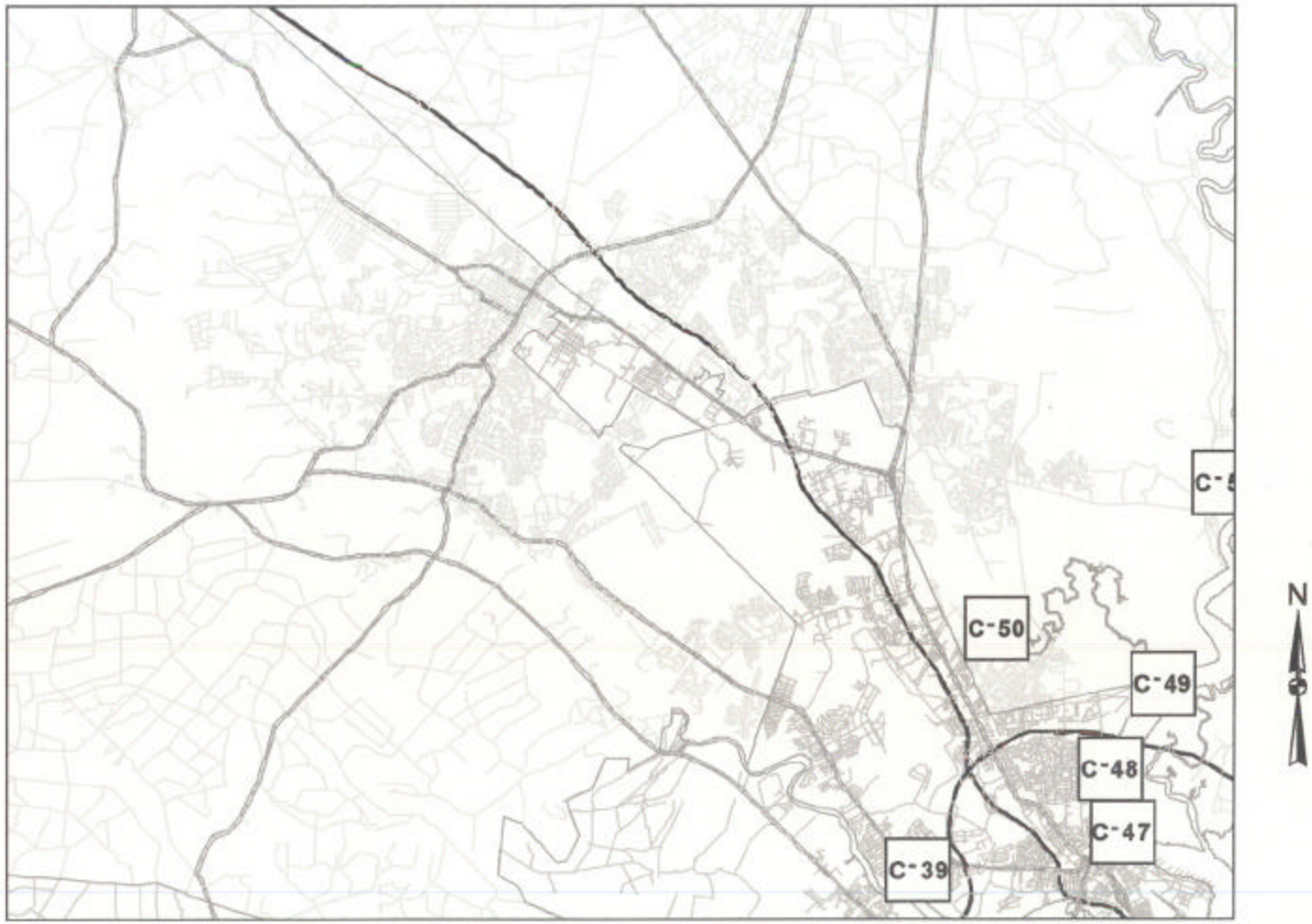
Time History Points
Plate 8



South Carolina Hurricane Evacuation Restudy

Figure 2-12 Time History Points Plate 8

Time History Points
Plate 9



South Carolina Hurricane Evacuation Restudy

Figure 2-13 Time History Points Plate 9

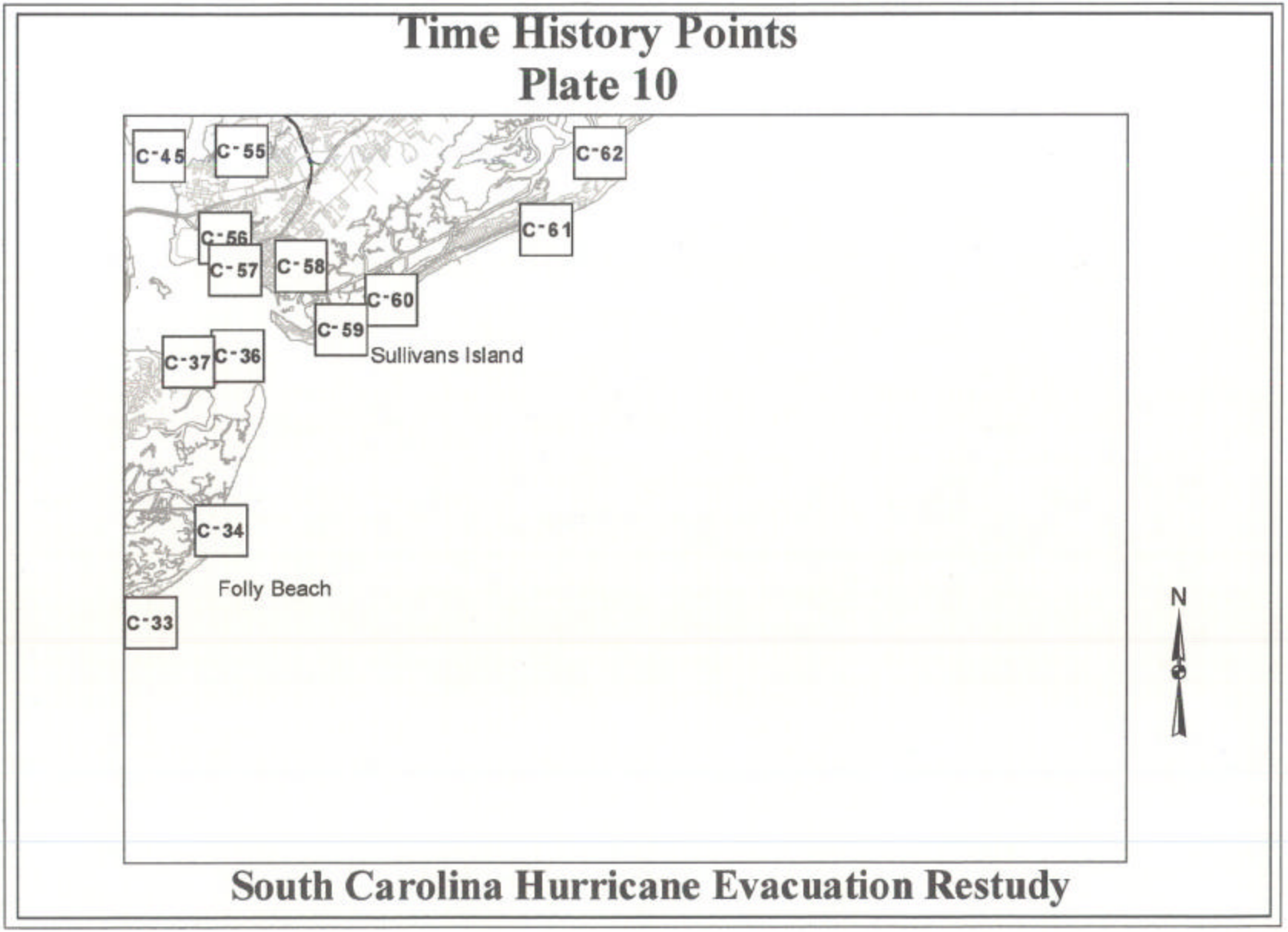
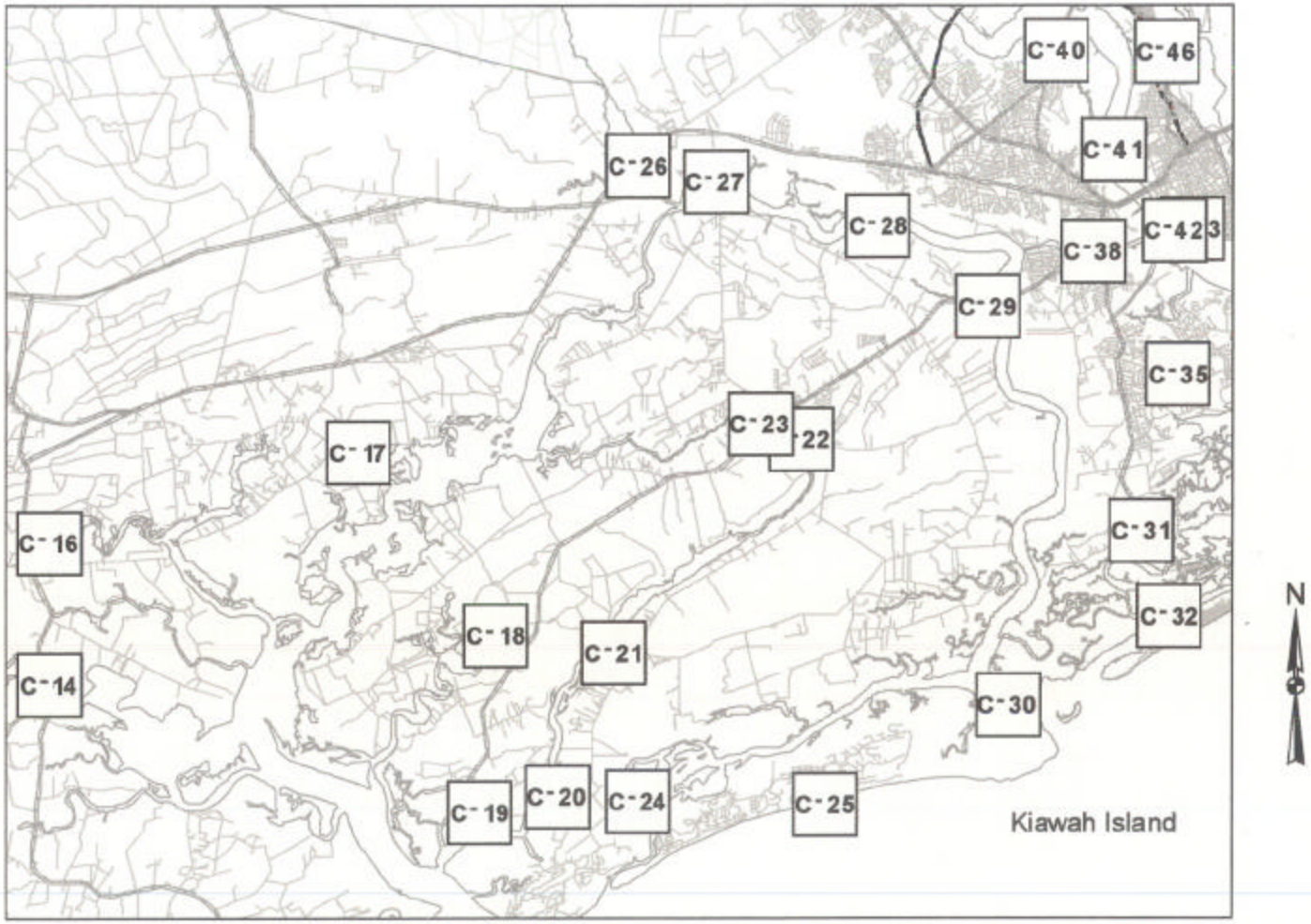


Figure 2-14 Time History Points Plate 10

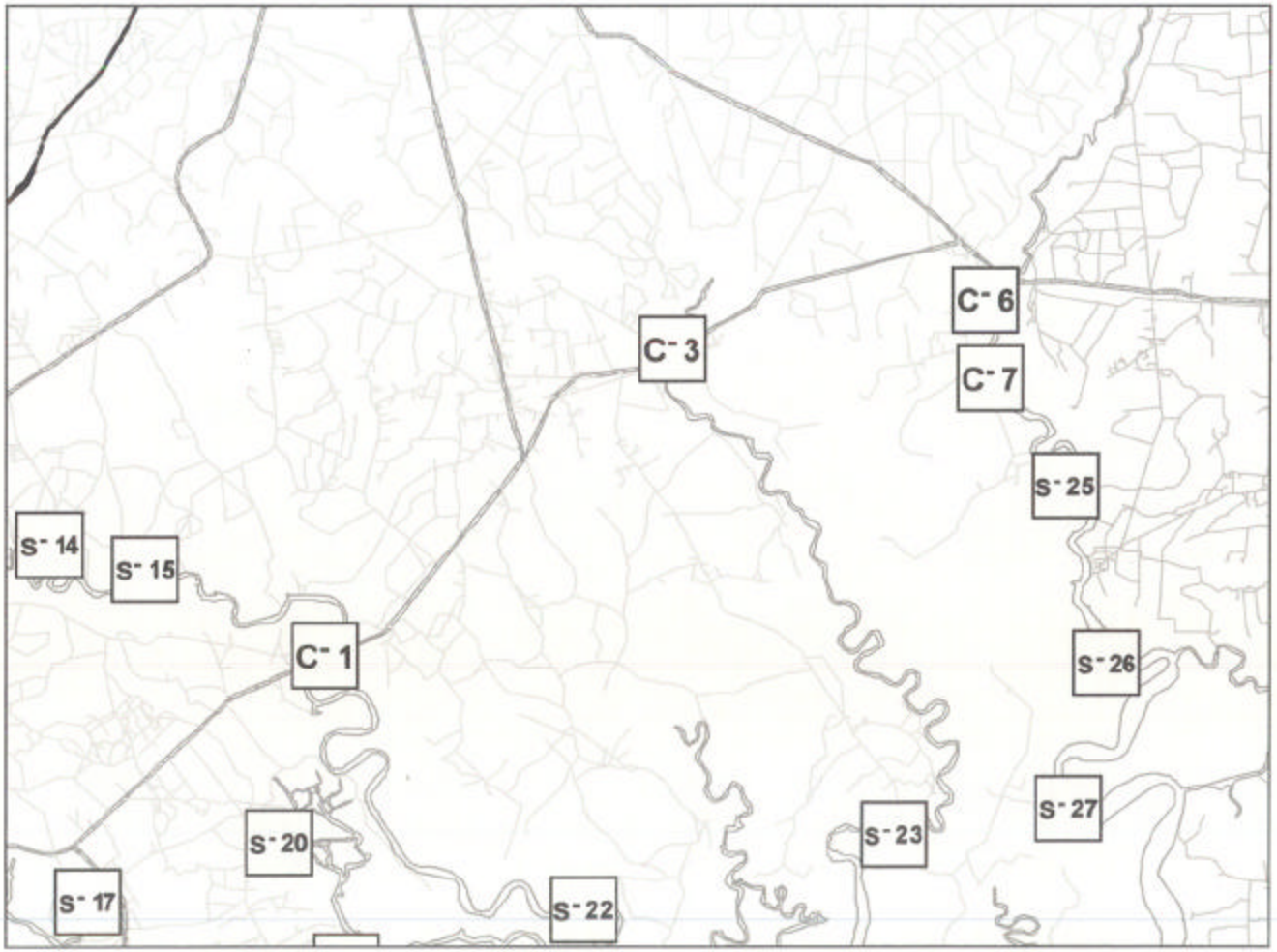
Time History Points
Plate 11



South Carolina Hurricane Evacuation Restudy

Figure 2-15 Time History Points Plate 11

Time History Points
Plate 12



South Carolina Hurricane Evacuation Restudy

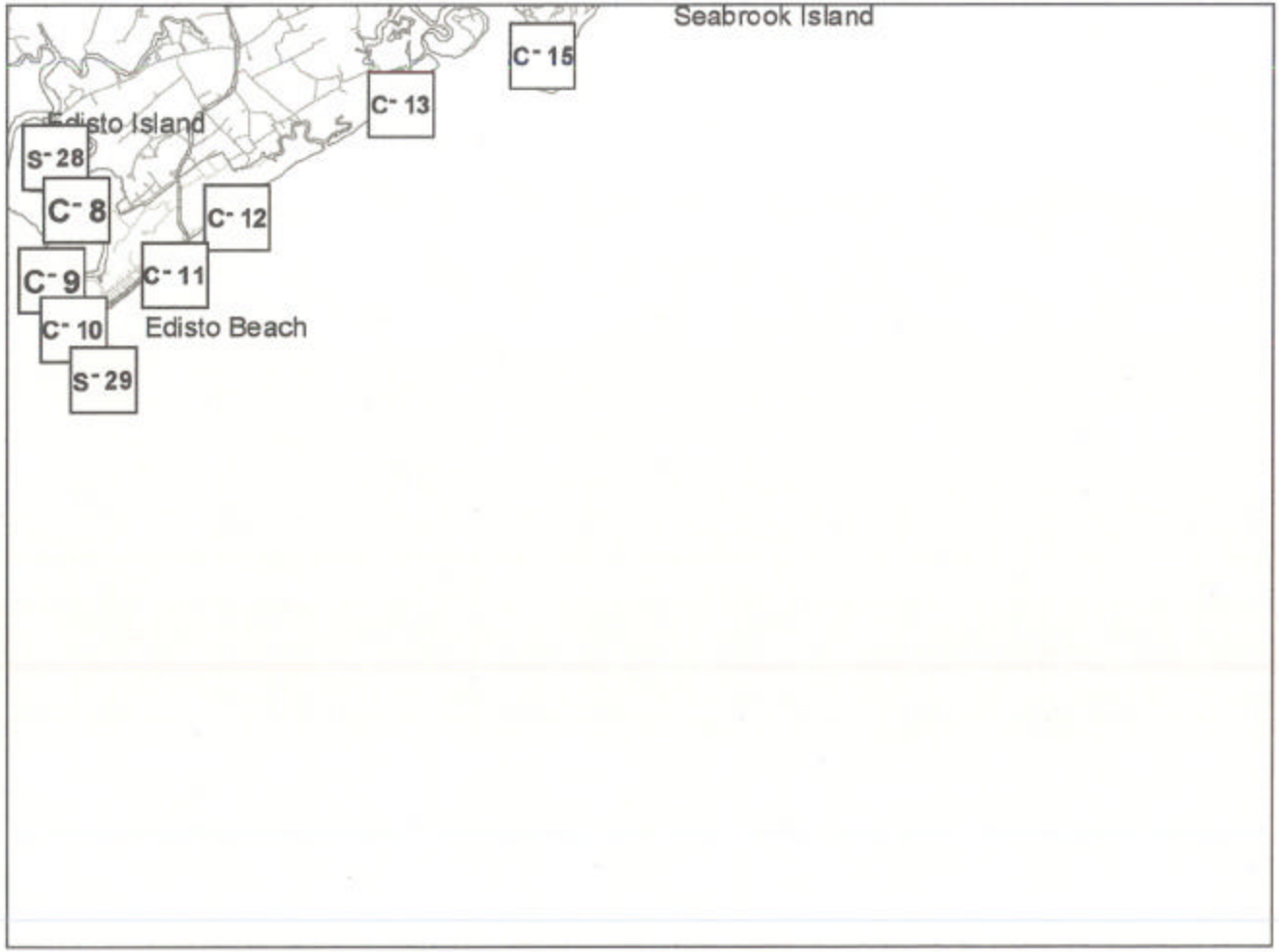
Figure 2-16 Time History Points Plate 12

Time History Points
Plate 13

South Carolina Hurricane Evacuation Restudy

Figure 2-17 Time History Points Plate 13

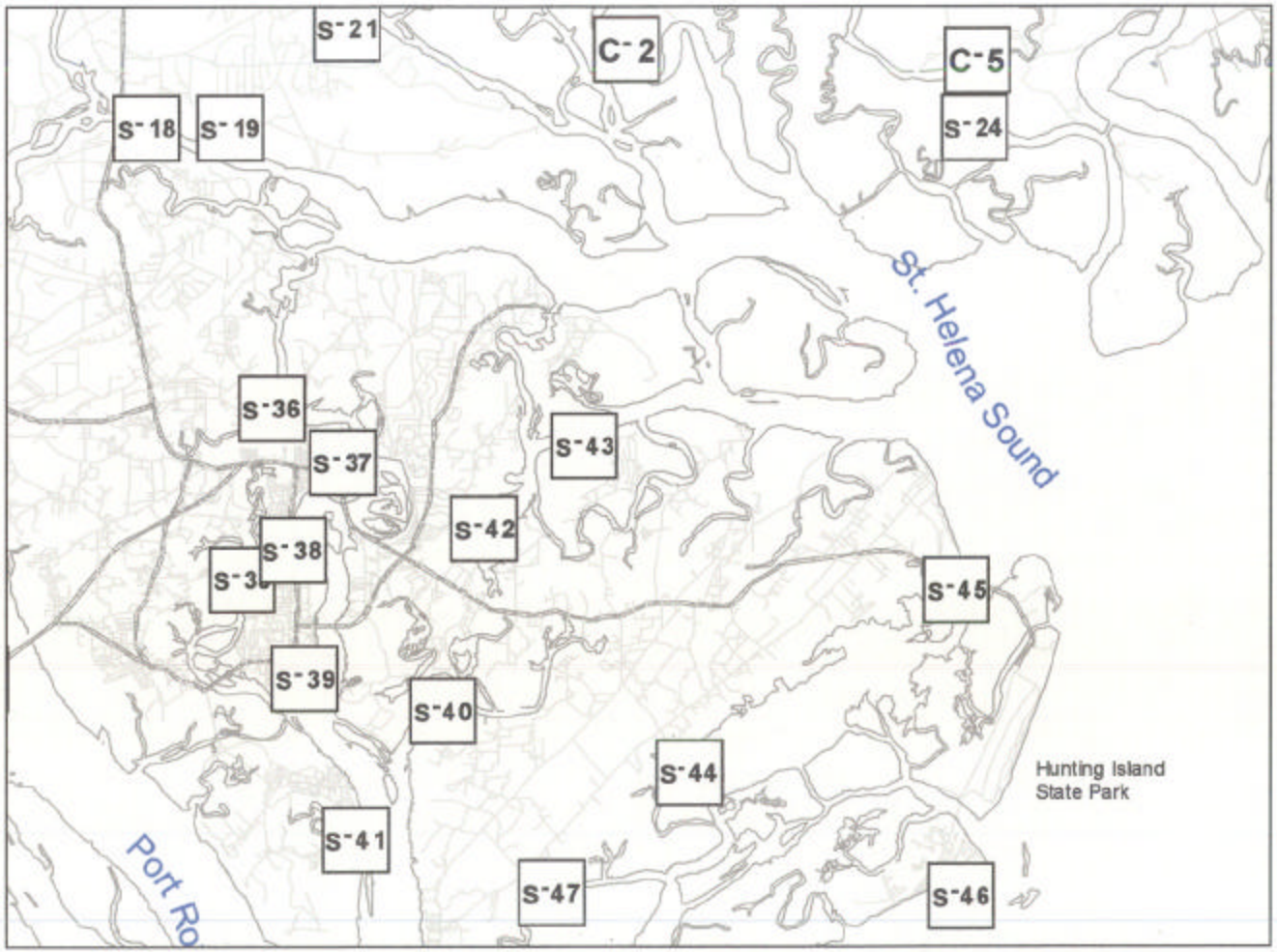
Time History Points
Plate 14



South Carolina Hurricane Evacuation Restudy

Figure 2-18 Time History Points Plate 14

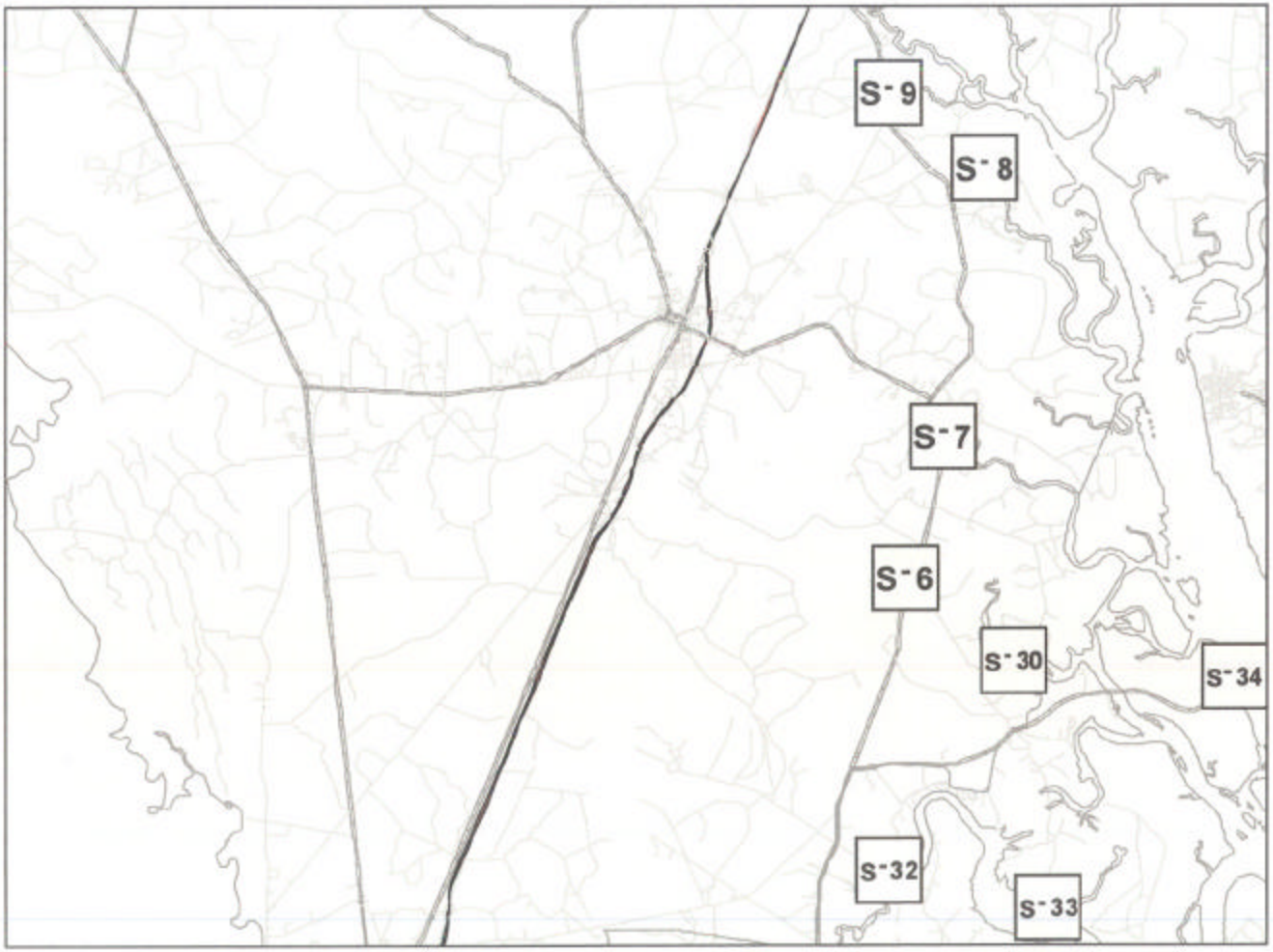
Time History Points
Plate 15



South Carolina Hurricane Evacuation Restudy

Figure 2-19 Time History Points Plate 15

Time History Points
Plate 16



South Carolina Hurricane Evacuation Restudy

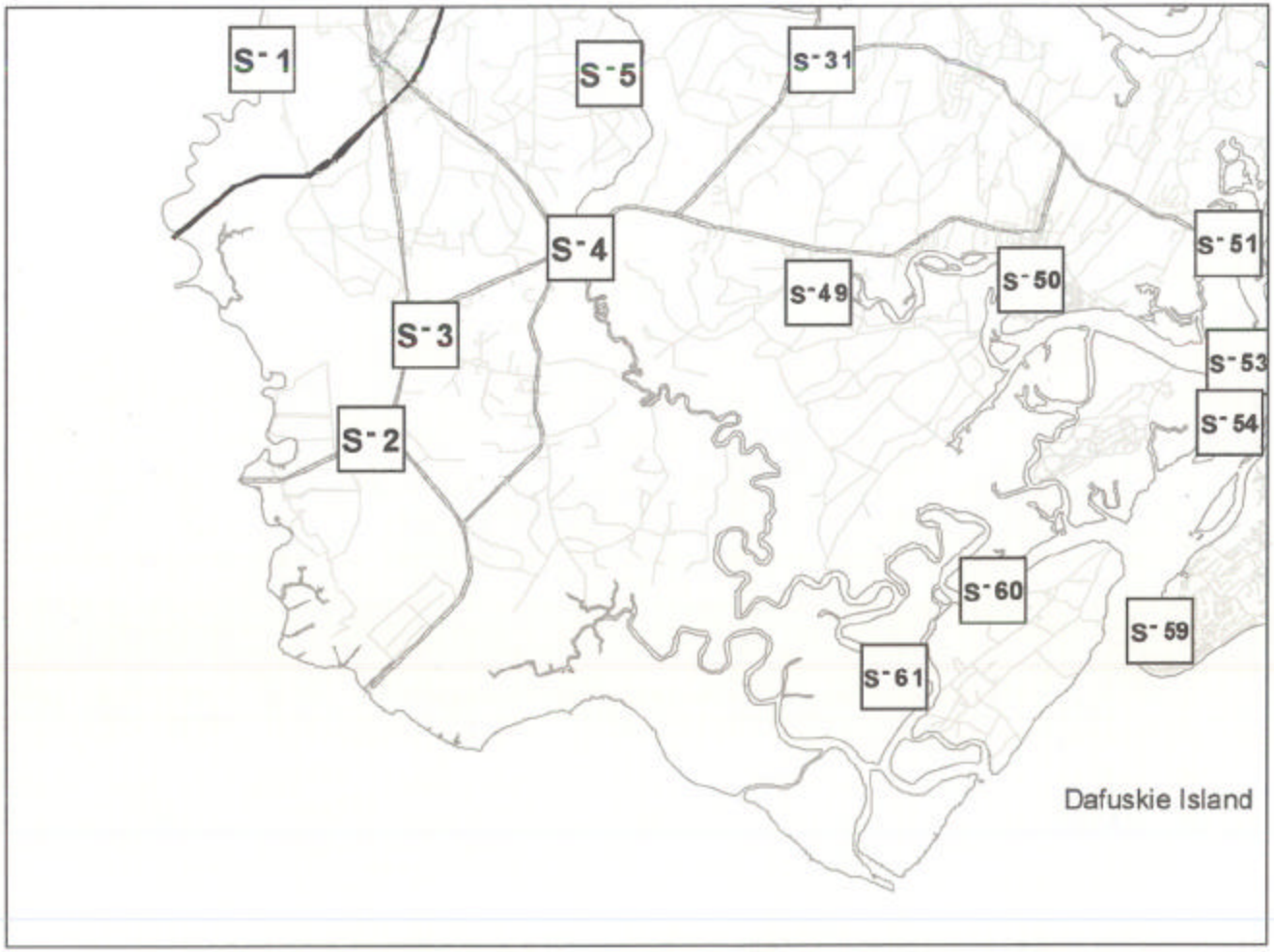
Figure 2-20 Time History Points Plate 16

Time History Points
Plate 17

South Carolina Hurricane Evacuation Restudy

Figure 2-21 Time History Points Plate 17

Time History Points
Plate 18



South Carolina Hurricane Evacuation Restudy

Figure 2-22 Time History Points Plate 18

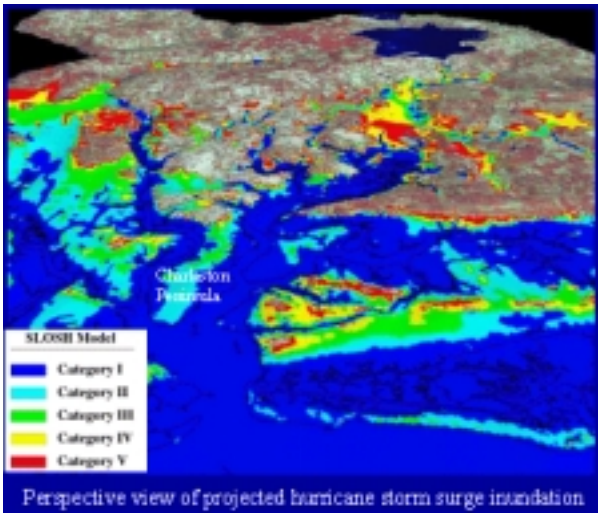
CHAPTER THREE -VULNERABILITY ANALYSIS

3.1 PURPOSE

The primary purpose of the vulnerability analysis is to identify the areas, populations, and facilities that are vulnerable to storm surge and to wind damage. Storm surge data from the hazards analysis were used to map inundation areas; to develop evacuation scenarios and evacuation zones; to quantify the vulnerable population; and to identify major medical, institutional, and other facilities that are potentially vulnerable to storm surge.

Since mobile homes have proven to be particularly susceptible to wind damage, they have been given special attention in the vulnerability analysis. No attempt has been made to identify other types of construction that may have a high risk of wind damage.

3.2 HURRICANE SURGE INUNDATION



Perspective view of projected hurricane storm surge inundation

Because of unavoidable inaccuracies in hurricane forecasting we cannot predict the exact track a hurricane will take. Within a few hours a hurricane can change its forward speed, intensity and direction which create quite different flooding scenarios at landfall. In response to this uncertainty, hurricane surge mapping depicts the maximum extent of storm surge flooding at high tide that is expected to be produced by any category hurricane regardless of its track or forward speed. Hurricane Surge Atlases, printed separately, showing peak surge flooding for the MOMs discussed in Chapter 2 have been produced as a separate document for coastal South Carolina. The maps are based on still water surge heights that include an upward adjustment for observed tidal anomalies before the arrival of the hurricane, and the coincidence of the surge arriving at the mean high astronomical tide. These factors add an additional +3.5 to +5.0 feet to the computed surge height. Since the extent of

flooding will actually depend a great deal on the hurricane track, the overall flooded area shown on the inundation maps for each hurricane category will never be exactly duplicated by a single storm.

To assess the vulnerability of areas, populations, and facilities to hurricane storm surge, the potential surge elevation must be compared to a specific location to predict whether flooding will occur during a range of storm scenarios. This section briefly explains the methodology used to assess potential vulnerabilities.

3.2.1 Surge Inundation Areas

To estimate the extent of flooding which can be expected from a hurricane making landfall along South Carolina's coast, results from the National Weather Service's Sea, Lake and Overland Surges from Hurricanes (SLOSH) computer model were run by the Storm Surge Group at the National Hurricane Center in Miami, Florida. Three models were used to predict the potential storm surge for the coast of South Carolina: the Wilmington/Myrtle Beach basin model, the Charleston basin model, and the Savannah/Hilton Head basin model. The output from these SLOSH models consists of predictions of water heights throughout these basins created by hurricanes making landfall along the South Carolina coast.

To create a storm surge map, digital terrain elevation models (DEM's) of the coast of South Carolina were developed (up to a 30 ft. contour) by scanning US Geological Survey (USGS) quadrangle sheets to create an electronic background map, and by digitizing topographic information from these quad sheets along with supplemental elevation data provided by the Corps of Engineers. By processing the hypsography (elevation contours) from the base maps, a ground surface model was created and merged with SLOSH model results to create a storm surge map. Where dry land was inundated during the merging of the terrain model and the SLOSH model, i.e., when the water surface elevation was greater than the terrain elevation, the area was shaded. The resulting maps represent the Maximum of the Maximum (MOM) storm surge composite of hypothetical storms calculated at high tide; one depicting storms with normal forward speeds (5 and 15 miles per hour), and one depicting storms with fast forward speeds (25 and 35 miles per hour.)

Typically, the results of computer modeling must be carefully reviewed to ensure that they reasonably simulate nature and produce credible results. Reviews of both the SLOSH model results and the developed surge maps uncovered a few areas of question. In the first example, the boundary conditions at the edge of the SLOSH grids, in some instances, suggested that the predicted storm surge would continue inland, beyond the limits of the SLOSH model, if data were available. To resolve this issue, where the National Weather Service model supplied no data, the DEM model was allowed to predict inland surge to the extent of the terrain model, i.e., to the 30 foot contour. The

boundary SLOSH surge values were either held constant or were "stepped down" to the limit of the digital terrain elevation model. Consultation with the National Weather Service Techniques Development Laboratory indicates that this approach is reasonable but probably overstates the likely surge limits. They also indicated that, because of the nature of the model, grid "boundary" condition SLOSH data is not reliable and may in itself overstate the predicted surge.

A review of the developed surge maps also indicated some anomalies. In this second instance, there are cases where the DEM model indicated a boundary condition surge penetrating an inland area that is not likely to be inundated. In another case, the DEM model results indicate areas inundated where there is no corridor or watercourse through which hurricane surge could travel to the inland location - the model simply compared the ground elevation to the water surface elevation.

The third area of model results that was analyzed, was the accuracy of the finished map. For example, the developed Category 4 surge maps indicates intermittent patches of dry land throughout the surge areas. These pockets of high land may in fact exist as indicated, however, due to United States Geological Survey (USGS) national map accuracy standards, they may be "off" by at least 1/2 contour interval (contours ranged from 2 meters to 10 feet). Further, errors in the models necessitates that these areas of high ground be considered "wet" for this type of critical analysis where lives may be jeopardized.

The net result of the anomalies in the model results is a healthy conservatism, which is inherent in the surge mapping. Because the error margin leans toward conservatism, the results were not "smoothed", modified, or adjusted for this analysis.

3.2.2 Surge Elevations

Surge elevation, or water height, is the output of the SLOSH model. This surge elevation, or water height is the computed still water height and does not include waves or wave run up. At each SLOSH grid point, the water height is the maximum value that was computed at that point during the model run time. The water height is calculated relative to mean sea level of 1929, also referred to as National Geodetic Vertical Datum (NGVD), and not relative to the ground elevation. Height of water above terrain is not calculated because terrain height varies within a SLOSH grid square. For example, the altitude of a 1-mile grid square may be assigned a value of 6 ft NGVD, but this value represents an average of land heights that may include values ranging from 3 ft to 9 ft NGVD. In this case, a surge value of 8 ft in this square, implying 2 ft average depth of water over the grid's terrain, would include some terrain without inundation and other parts with as much as 5 ft of overlying water. Therefore, the depth of surge flooding above terrain at a specific site in the grid square is deduced by subtracting the actual

terrain height from the model-generated storm surge height in that square. It should be noted that, even if the SLOSH model is supplied accurate data, the computed surges may contain errors of ± 20% of observed water levels.

Because tidal anomalies of about +1 ft NGVD before arrival of a hurricane are not uncommon, the initial water heights used for each SLOSH model run simulate conditions at high tide. In the Wilmington/Myrtle Beach and the Charleston basin models, all SLOSH runs of hypothetical hurricanes were supplied with initial tidal datum of +3.5 ft NGVD (ocean) or +3.0 ft NGVD (bays and lakes). In the Savannah/Hilton Head basin model, +5.0 ft NGVD was included in SLOSH model runs to simulate conditions at high tide.

3.3 HURRICANE CLEARANCE TIME MODELING ZONES

Hurricane clearance time modeling zones are the areas that need to be evacuated for a particular hurricane scenario to protect residents at risk from storm surge flooding. These zones were developed for each county based on the following parameters:

- Be describable over radio/TV media to the public
- Be based upon easily identifiable roadway or natural features for boundary identification
- Relate to storm surge limits based on the most recent SLOSH model runs
- In hard copy, allow coastal county residents to determine if their home is in a storm surge vulnerable evacuation area
- Be usable for transportation modeling/clearance time calculations
- Be related to census/traffic analysis zone boundaries for population and dwelling unit tabulations and calculation of vulnerable populations

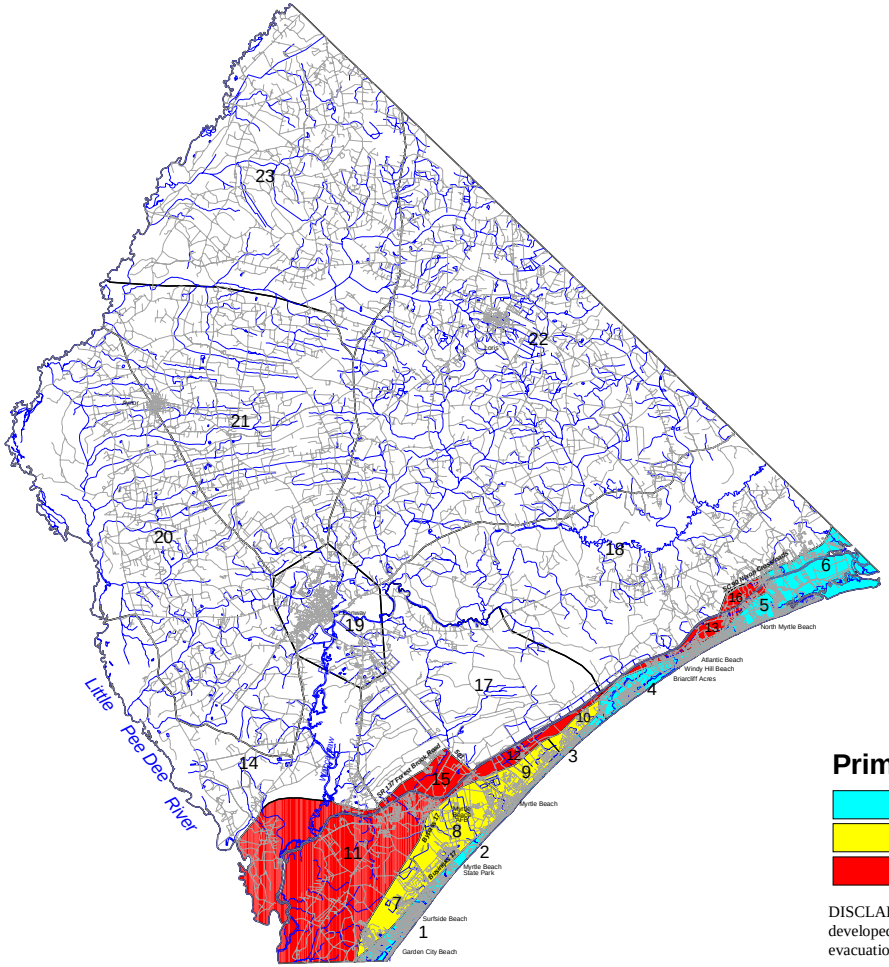
Eight of the nine coastal counties have delineated several clearance time modeling zones based on the hurricane surge flooding. These zones have been used to estimate the evacuating population and number of evacuating vehicles. This information is a key element to the transportation analysis. Table 3-1 shows the clearance time modeling zones and the hurricane categories for each county. Figures 3-1 through 3-8 show a map of the evacuation zones for eight of the nine coastal counties. Clearance time modeling zones were not developed for Hampton county due to the very limited impact of hurricane storm surge. For a description of the South Carolina Clearance time modeling zones see appendix A.

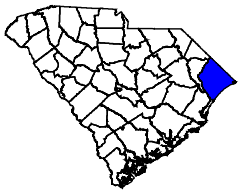
Table 3-1. Clearance Time Modeling Zones

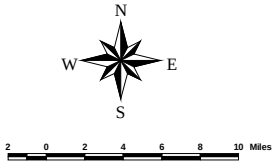
County	**Clearance Time Modeling Zones**	**All Residents in Traffic Zones :**
Jasper	Evacuation Zone Cat1-2 Evacuation Zone Cat 3-5	1-3 1-7
Beaufort	Evacuation Zone Cat1 Evacuation Zone Cat 2 Evacuation Zone Cat 3-5	1-9 1-13, 15-24 1-24
Colleton	Evacuation Zone Cat1 Evacuation Zone Cat 2-5	1-2 1-4
Charleston	Evacuation Zone Cat1 Evacuation Zone Cat 2 Evacuation Zone Cat 3 Evacuation Zone Cat 4-5	1-8, 13-16 1-10, 17, 19, 20 1-25 1-25, 27
Dorchester	Evacuation Zone Cat 1-3 Evacuation Zone Cat 4-5	1 1-2
Berkeley	Evacuation Zone Cat 1-3 Evacuation Zone Cat 4-5	1-3 1-4
Georgetown	Evacuation Zone Cat 1-2 Evacuation Zone Cat 3 Evacuation Zone Cat 4-5	1-5,8 1-5, 8-10 1-13
Horry	Evacuation Zone Cat 1-2 Evacuation Zone Cat 3-4 Evacuation Zone Cat 5	1-6 1-10 1-13, 15-16

Clearance Time Modeling Zones

Horry County







Primary Evacuation Areas By Storm Scenario

- Category 1-2 Primary Evacuation Areas
- Category 3-4 Additional Primary Evacuation Areas
- Category 5 Additional Primary Evacuation Areas

DISCLAIMER: Actual surge vulnerability of structures must be determined from the storm surge atlases developed by the US Army Corps of Engineers. This graphic is only to be used for depicting major areas of evacuation for transportation clearance time modeling.

South Carolina Hurricane Evacuation Restudy

Figure 3-1. Clearance Time Modeling Zones, Horry County

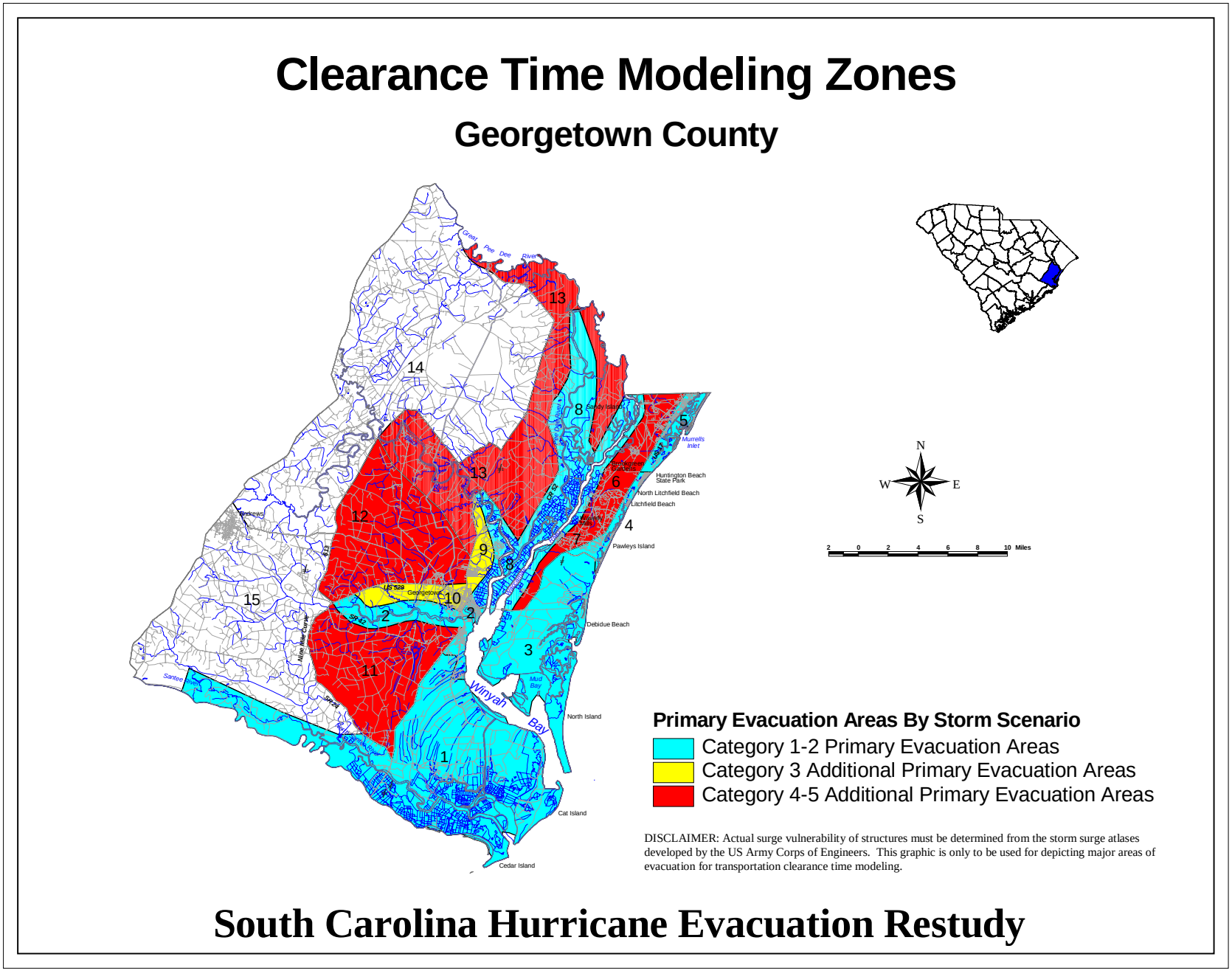


Figure 3-2. Clearance Time Modeling Zones, Georgetown County

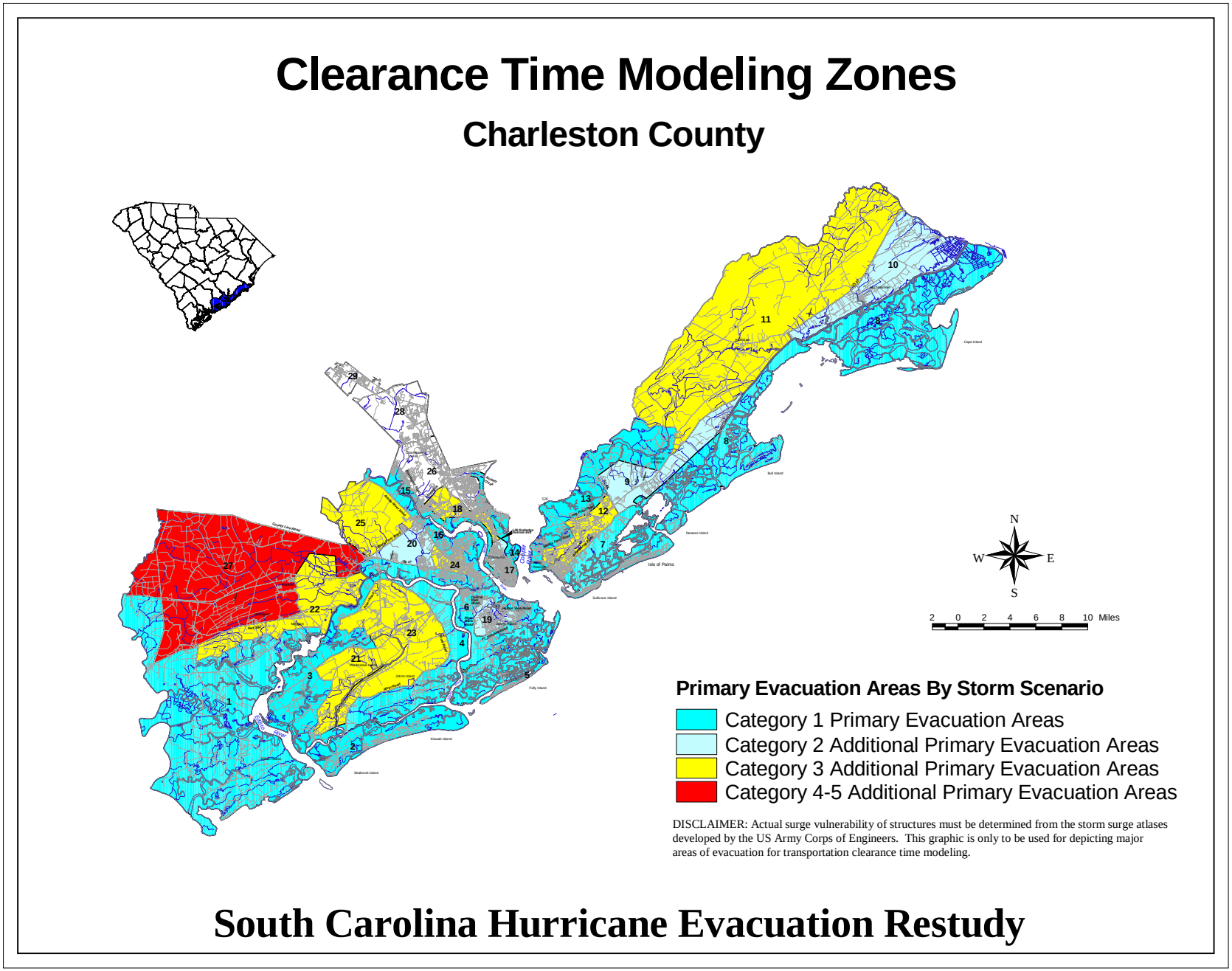


Figure 3-3. Clearance Time Modeling Zones, Charleston County

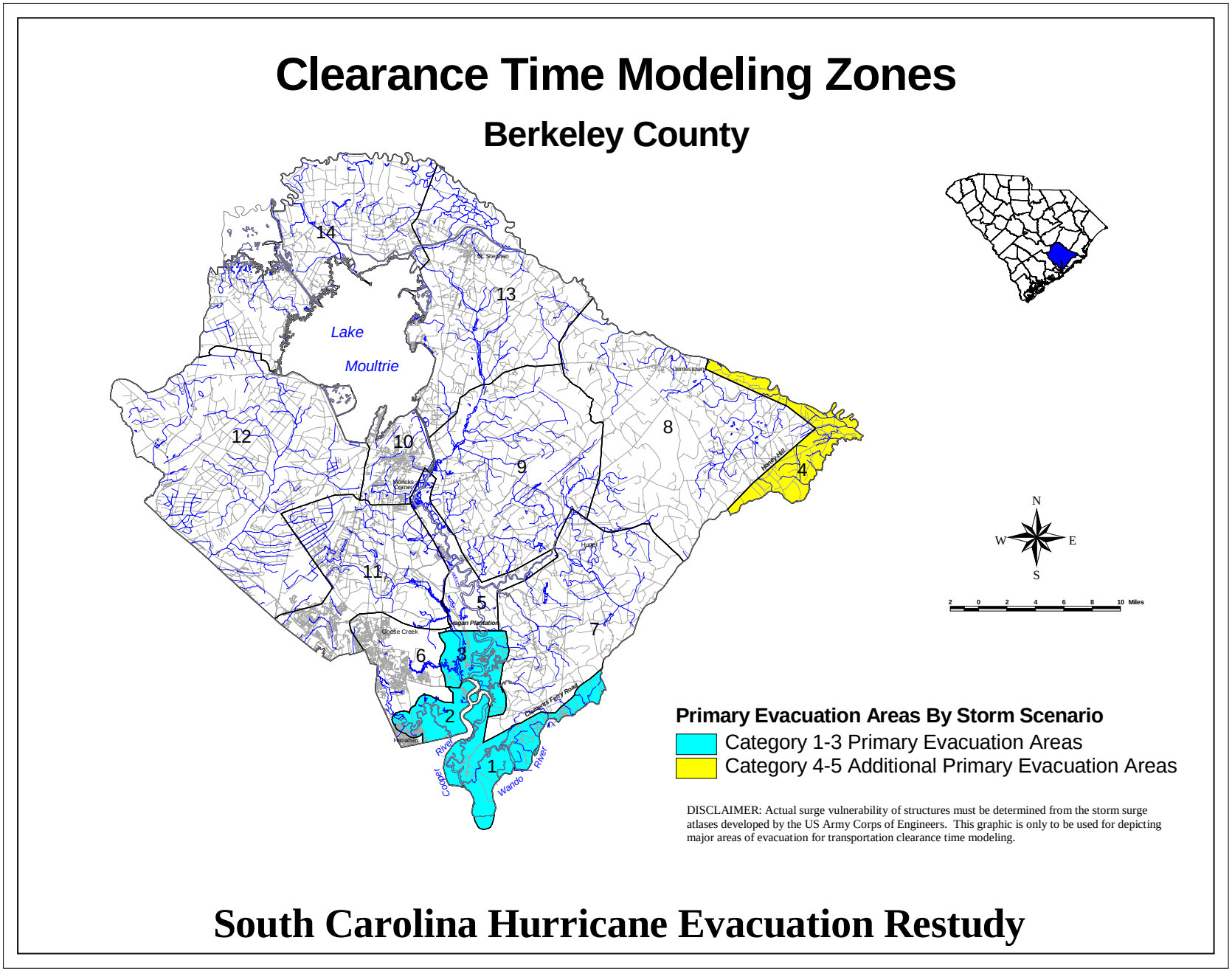
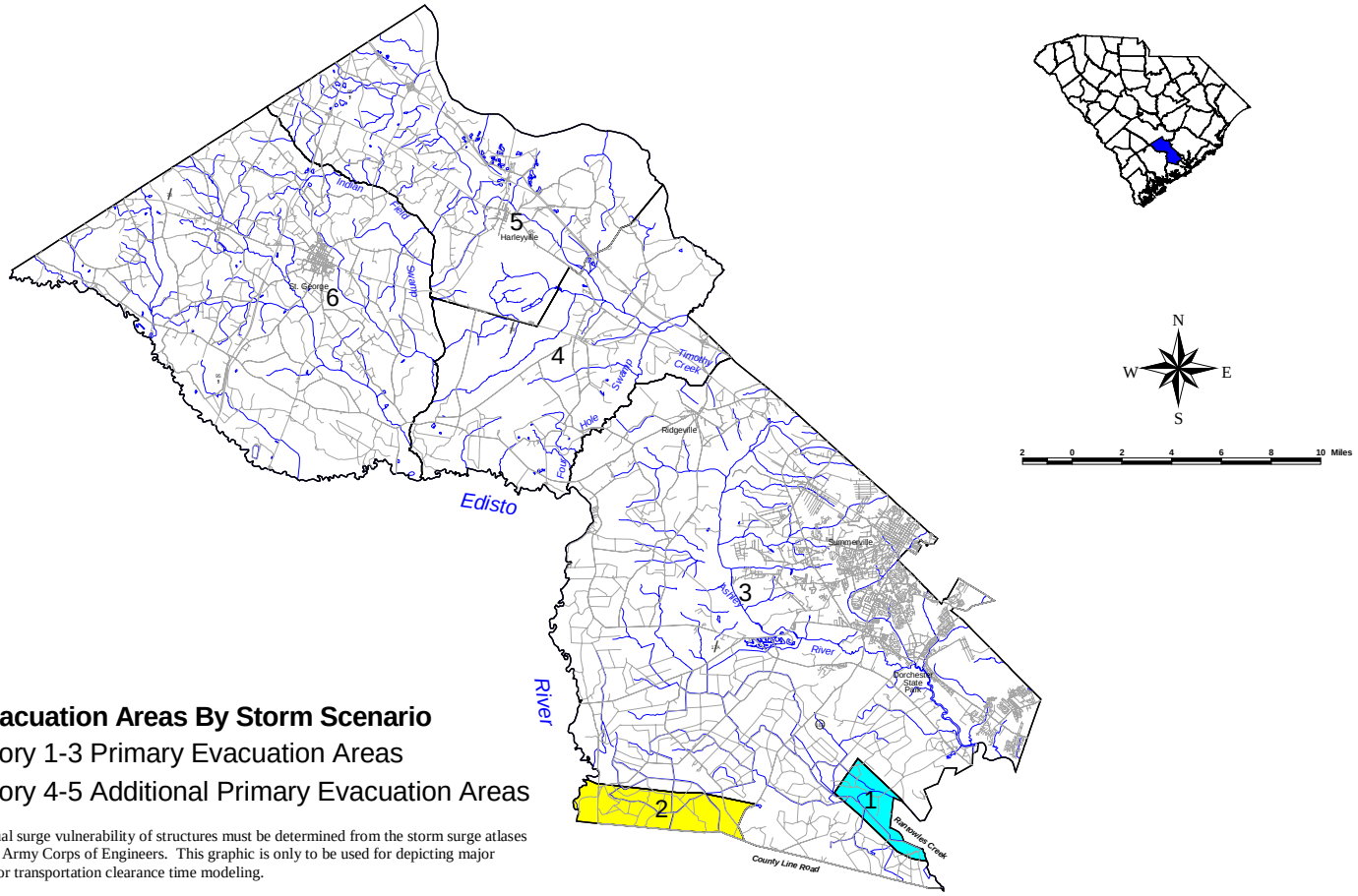


Figure 3-4. Clearance Time Modeling Zones, Berkeley County

Clearance Time Modeling Zones

Dorchester County



Primary Evacuation Areas By Storm Scenario

- Category 1-3 Primary Evacuation Areas
- Category 4-5 Additional Primary Evacuation Areas

DISCLAIMER: Actual surge vulnerability of structures must be determined from the storm surge atlases developed by the US Army Corps of Engineers. This graphic is only to be used for depicting major areas of evacuation for transportation clearance time modeling.

South Carolina Hurricane Evacuation Restudy

Figure 3-5. Clearance Time Modeling Zones, Dorchester County

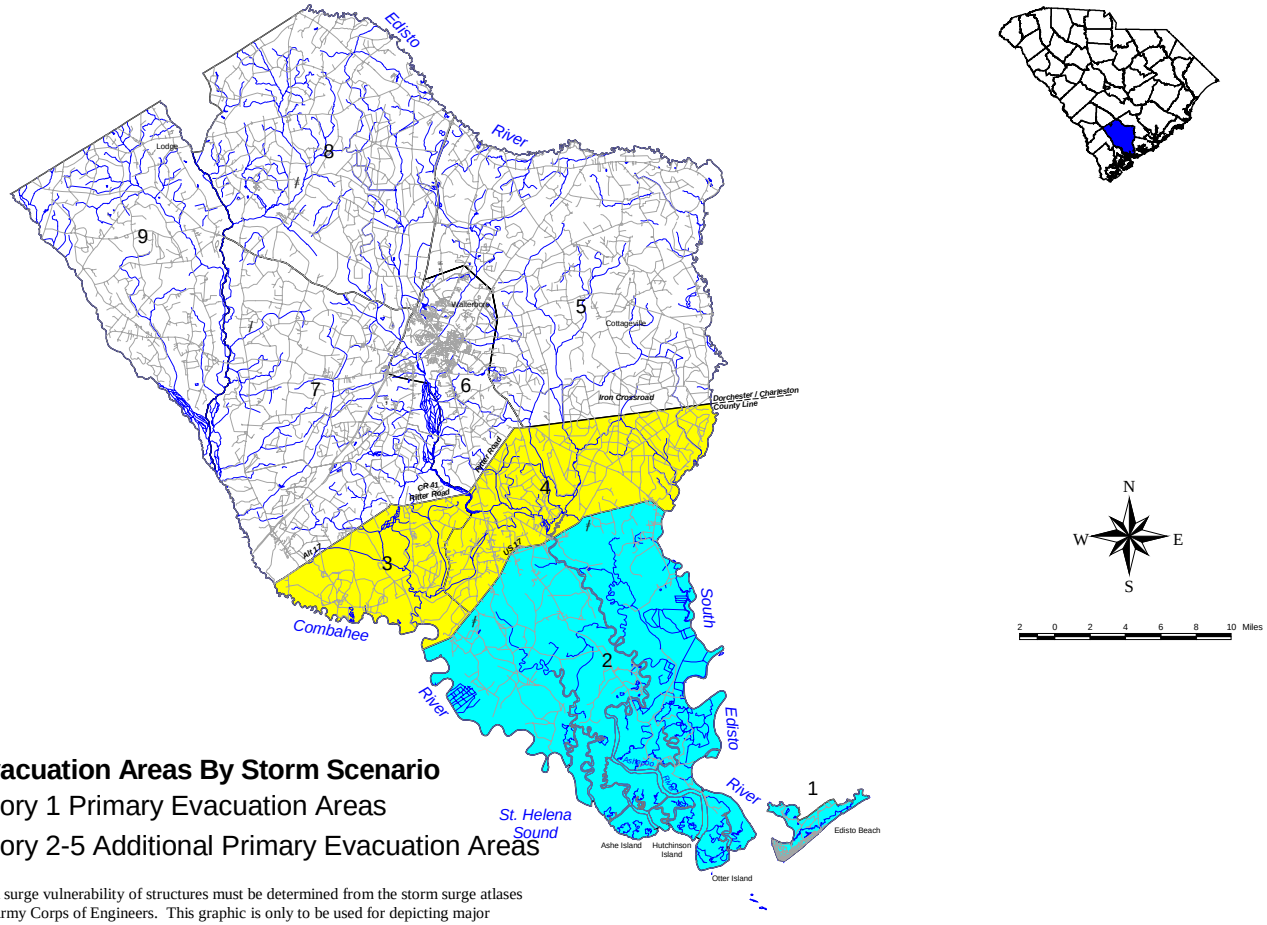
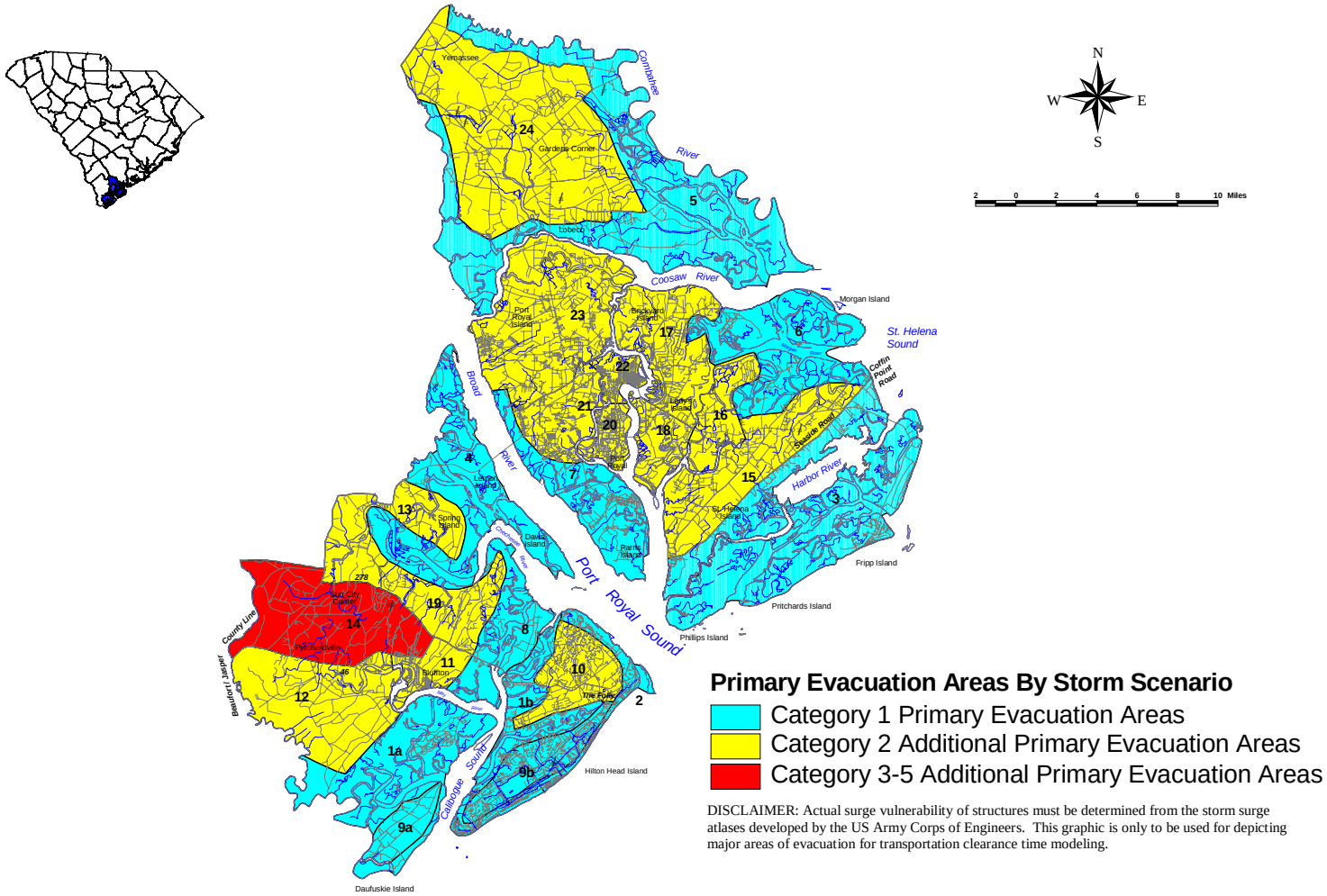


Figure 3-6. Clearance Time Modeling Zones, Colleton County

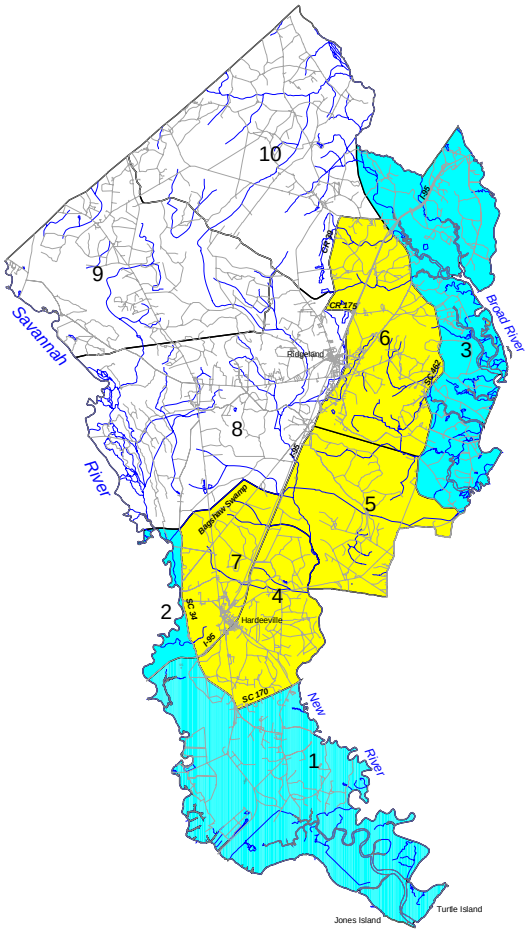


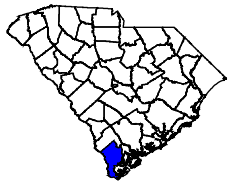
South Carolina Hurricane Evacuation Restudy

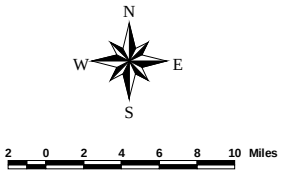
Figure 3-7. Clearance Time Modeling Zones, Beaufort County

Clearance Time Modeling Zones

Jasper County







Primary Evacuation Areas By Storm Scenario

- Category 1-2 Primary Evacuation Areas
- Category 3-5 Additional Primary Evacuation Areas

DISCLAIMER: Actual surge vulnerability of structures must be determined from the storm surge atlases developed by the US Army Corps of Engineers. This graphic is only to be used for depicting major areas of evacuation for transportation clearance time modeling.

South Carolina Hurricane Evacuation Restudy

Figure 3-8. Clearance Time Modeling Zones, Jasper County

3.4 VULNERABLE POPULATION

The vulnerable population, or population at greatest risk are persons residing within the evacuation zones subject to storm surge and the residents of mobile homes which may be threatened by hurricane force winds. Mobile home residents are usually advised to evacuate when they may be subjected to hurricane winds because of their proven vulnerability to hurricane force winds. The tourist population varies with the tourist season. For the purposes of this study a low and high tourist population has been estimated. The high tourist population is based on 90% occupancy of tourist units and the low tourist population is based on 30%. Table 3-2 is the coastal county key population/dwelling unit summary. Table 3-3 summarizes the vulnerable population of inland residents residing in mobile homes. Figures 3-9 through 3-49 illustrate the vulnerable population by county and traffic zone.

Table 3-2
COASTAL COUNTY KEY POPULATION/DWELLING UNIT SUMMARY
South Carolina Hurricane Evacuation Restudy

Horry County
Year 2000 Permanent Population -199,700 people
Permanent occupied dwelling units - 77,100 units
Mobile homes - 10,100 units (permanent resident mobile homes)
Tourist/seasonal units - 51,300 units (includes seasonal mobile homes)
People per permanent unit - 2.59
Vehicles per permanent unit - 1.58

Georgetown County
Year 2000 Permanent Population - 53,700 people
Permanent occupied dwelling units - 18,800 units
Mobile homes - 7,000 units
Tourist/seasonal units - 5,600 units
People per permanent unit - 2.85
Vehicles per permanent unit - 1.56

Table 3-2 (Continued)
KEY POPULATION/DWELLING UNIT SUMMARY BY COUNTY
South Carolina Hurricane Evacuation Restudy

Charleston County
Year 2000 Permanent Population - 311,700 people
Permanent occupied dwelling units - 112,950 units
Mobile homes - 12,150 units
Tourist/seasonal units - 14,700 units
People per permanent unit - 2.76
Vehicles per permanent unit - 1.50

Berkeley County
Year 2000 Permanent Population - 149,100 people
Permanent occupied dwelling units - 49,000 units
Mobile homes - 14,500 units
Tourist/seasonal units - 2,200 units
People per permanent unit - 3.04
Vehicles per permanent unit - 1.75

Dorchester County
Year 2000 Permanent Population - 97,800 people
Permanent occupied dwelling units - 33,300 units
Mobile homes - 6,000 units
Tourist/seasonal units - 800 units
People per permanent unit - 2.94
Vehicles per permanent unit - 1.77

Colleton County
Year 2000 Permanent Population - 38,600 people
Permanent occupied dwelling units - 13,500 units
Mobile homes - 6,700 units
Tourist/seasonal units - 2,300 units
People per permanent unit - 2.86
Vehicles per permanent unit - 1.53

Table 3-2 (Continued)
KEY POPULATION/DWELLING UNIT SUMMARY BY COUNTY
South Carolina Hurricane Evacuation Restudy

Beaufort County
Year 2000 Permanent Population - 109,200 people
Permanent occupied dwelling units - 40,900 units
Mobile homes - 10,100 units
Tourist/seasonal units - 17,800 units
People per permanent unit - 2.67 (Variable by subarea)
Vehicles per permanent unit - 1.61 (Variable by subarea)

Jasper County
Year 2000 Permanent Population - 18,200 people
Permanent occupied dwelling units - 6,300 units
Mobile homes - 2,000 units
Tourist/seasonal units - 200 units
People per permanent unit - 2.87
Vehicles per permanent unit - 1.42

Table 3-3
INLAND COUNTY MOBILE HOME SUMMARY BY COUNTY
South Carolina Hurricane Evacuation Restudy

Inland County	Year 2000 Mobile Homes	Year 2000 Mobile Home Population
Northern Conglomerate		
Clarendon	4,300 Units	12,800 People
Darlington	7,920 Units	22,300 People
Dillon	3,800 Units	11,200 People
Florence	13,390 Units	38,000 People
Lee	2,000 Units	6,100 People
Marlboro	2,500 Units	7,300 People
Marion	3,000 Units	8,600 People
Sumter	10,500 Units	32,400 People
Williamsburg	7,880 Units	23,900 People

Table 3-3
INLAND COUNTY MOBILE HOME SUMMARY BY COUNTY
South Carolina Hurricane Evacuation Restudy

Inland County	Year 2000 Mobile Homes	Year 2000 Mobile Home Population
Central Conglomerate		
Calhoun	2,000 Units	5,680 People
Lexington	15,000 Units	40,800 People
Orangeburg	10,000 Units	29,300 People
Richland	10,000 Units	28,200 People
Southern Conglomerate		
Aiken	12,940 Units	34,900 People
Allendale	1,000 Units	3,090 People
Bamberg	1,700 Units	5,150 People
Barnwell	3,600 Units	10,300 People
Hampton	3,200 Units	9,200 People
Orangeburg	10,000 Units	29,300 People

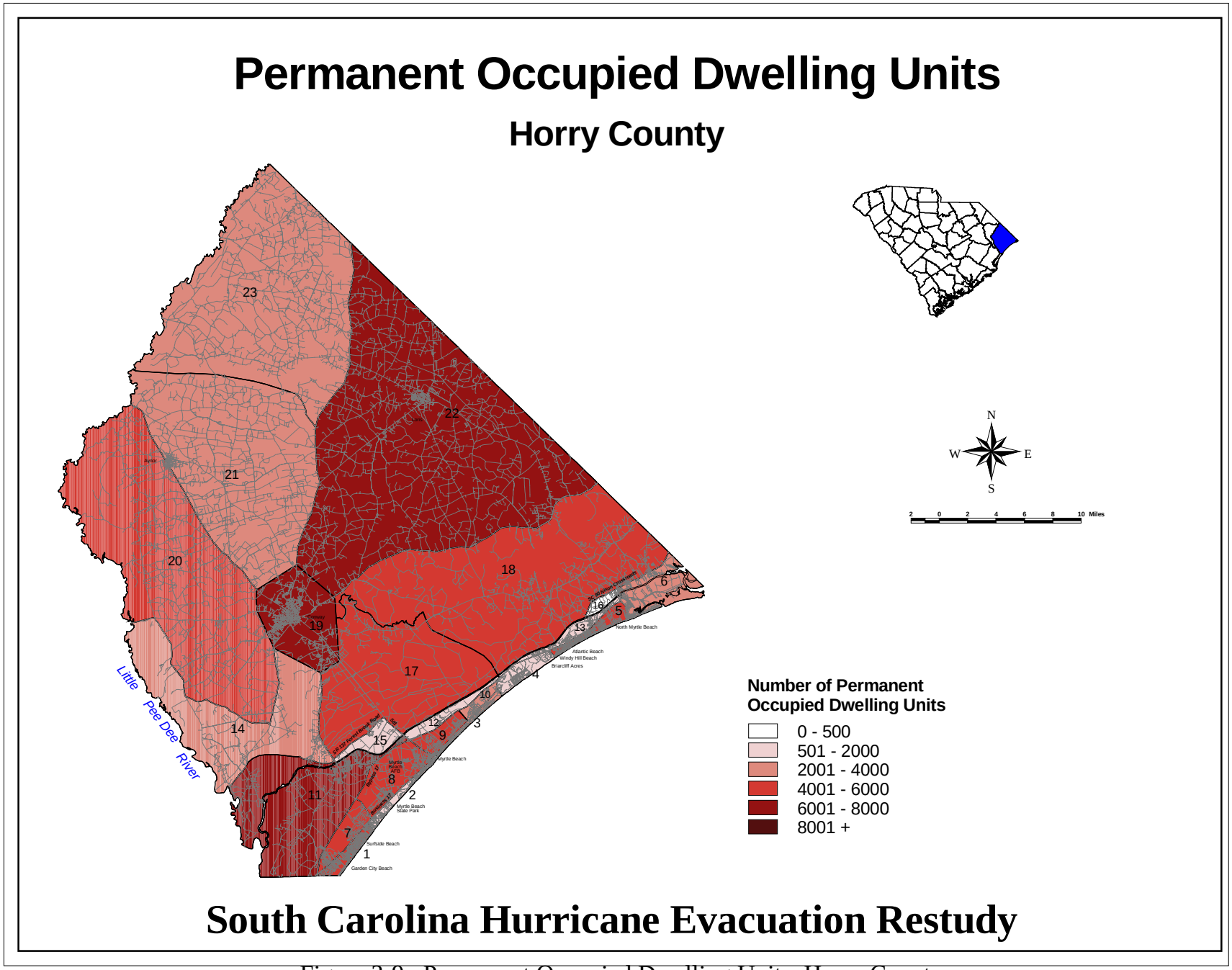


Figure 3-9. Permanent Occupied Dwelling Units, Horry County

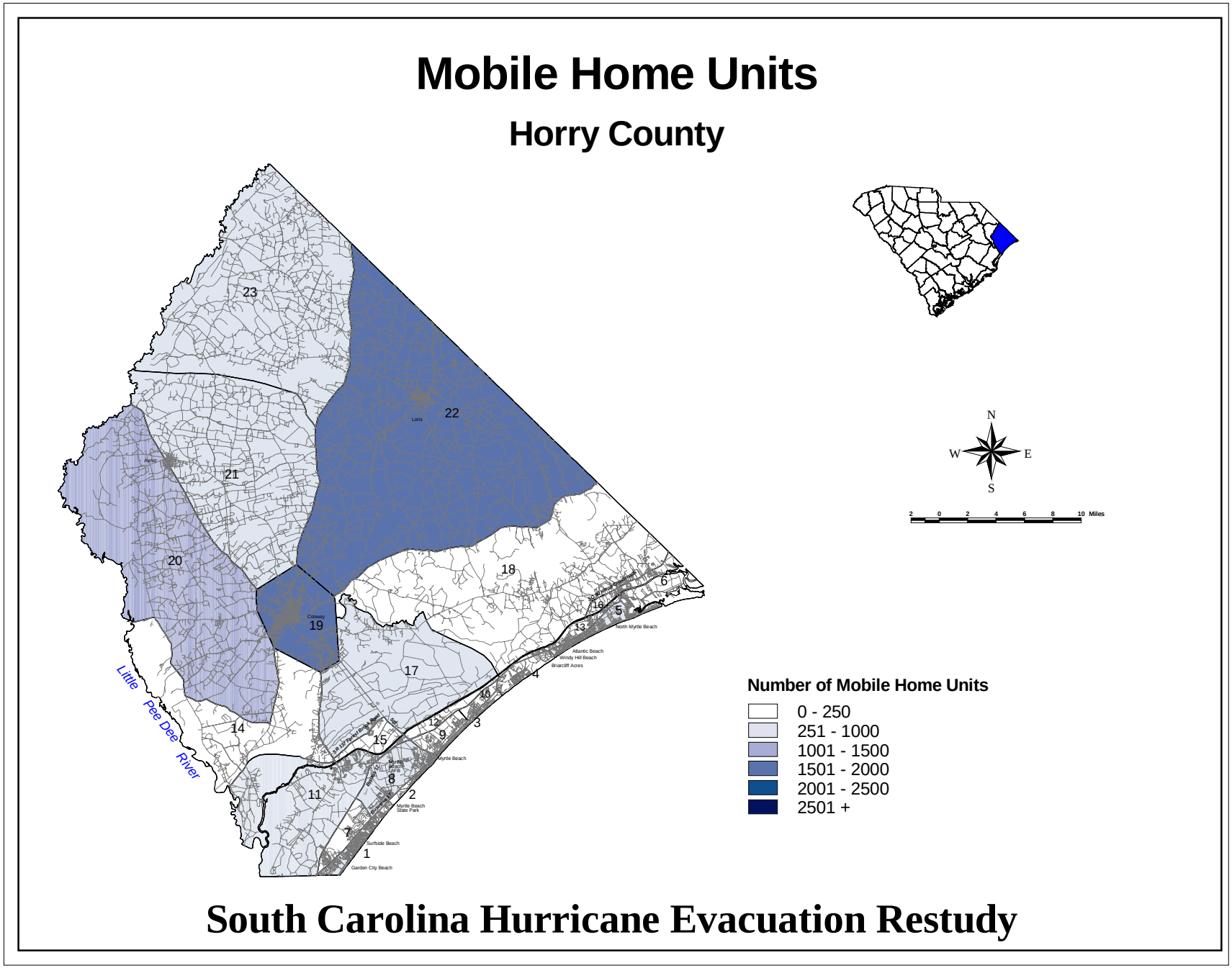


Figure 3-10. Mobile Home Units, Horry County

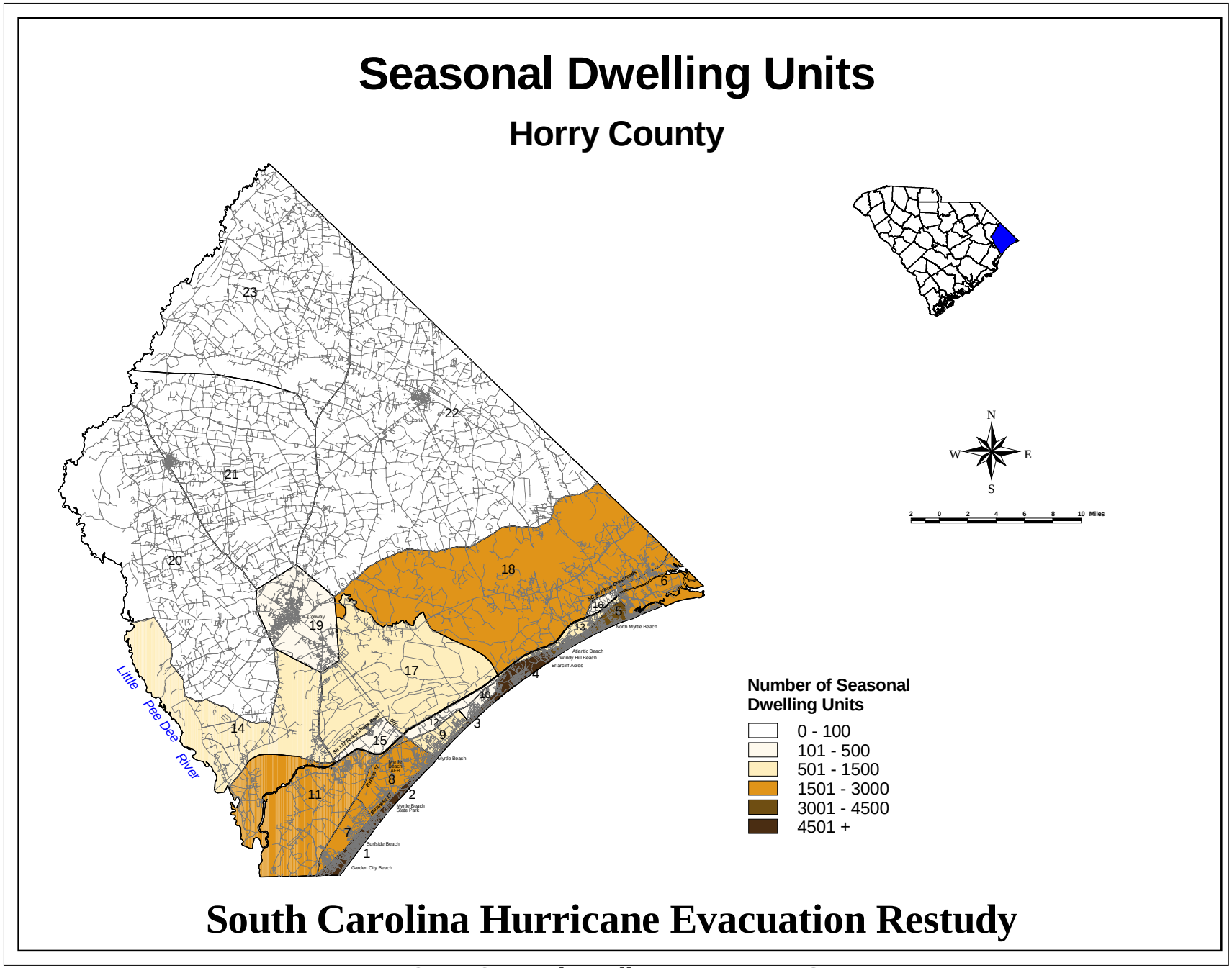


Figure 3-11. Seasonal Dwelling Units, Horry County

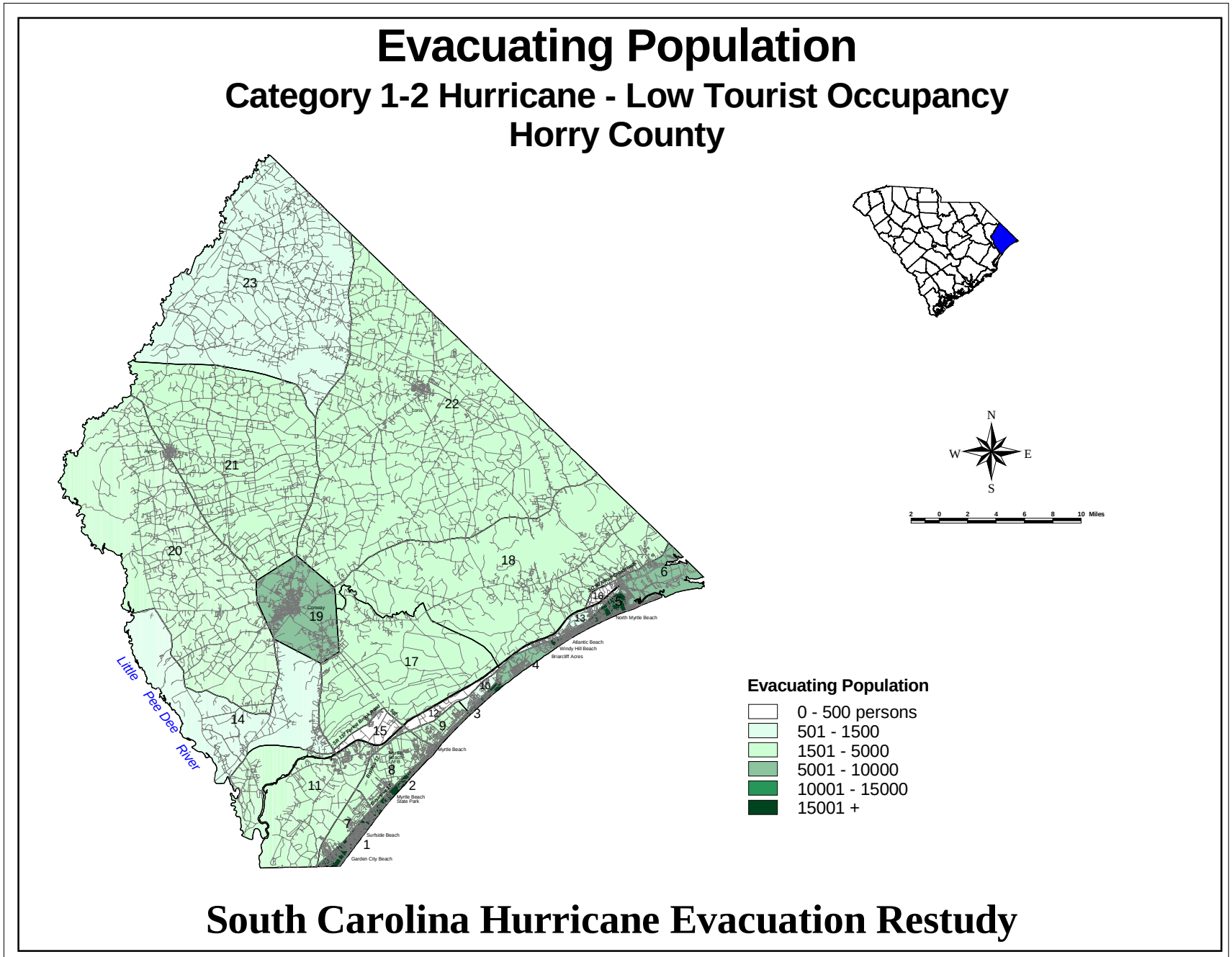


Figure 3-12. Evacuating Population Category 1-2 Low Tourist Occupancy, Horry County

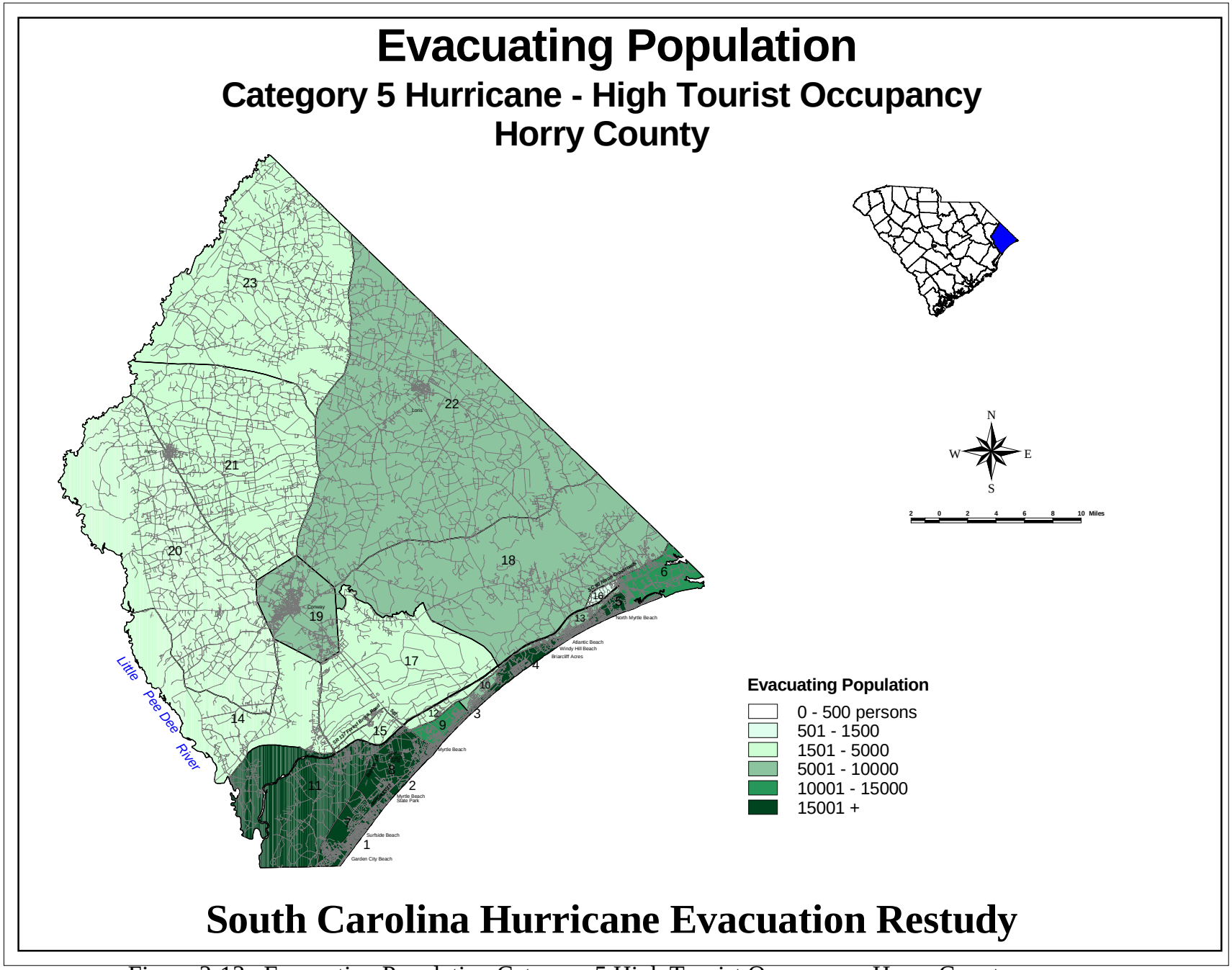


Figure 3-13. Evacuating Population Category 5 High Tourist Occupancy, Horry County

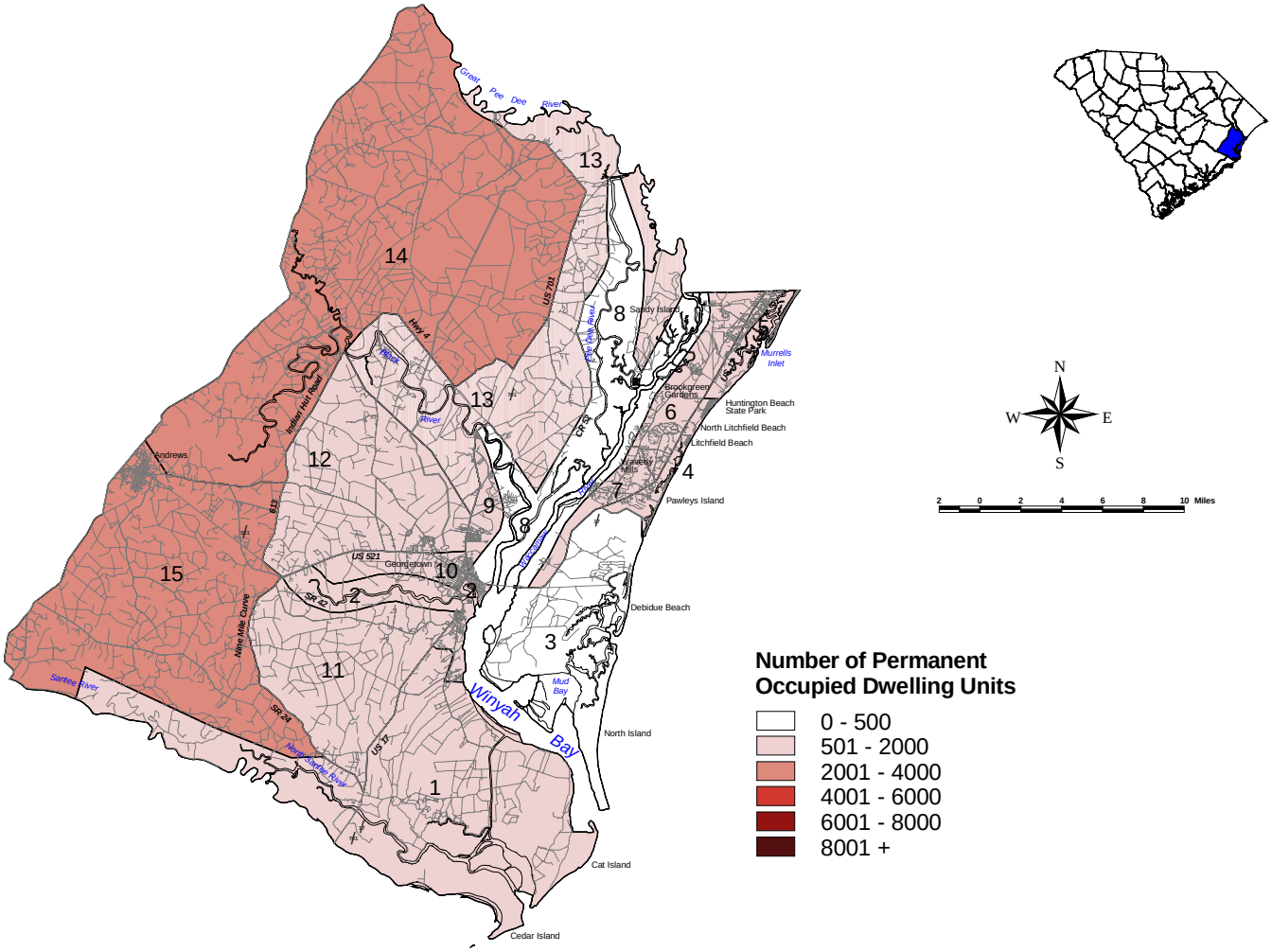


Figure 3-14. Permanent Occupied Dwelling Units, Georgetown County

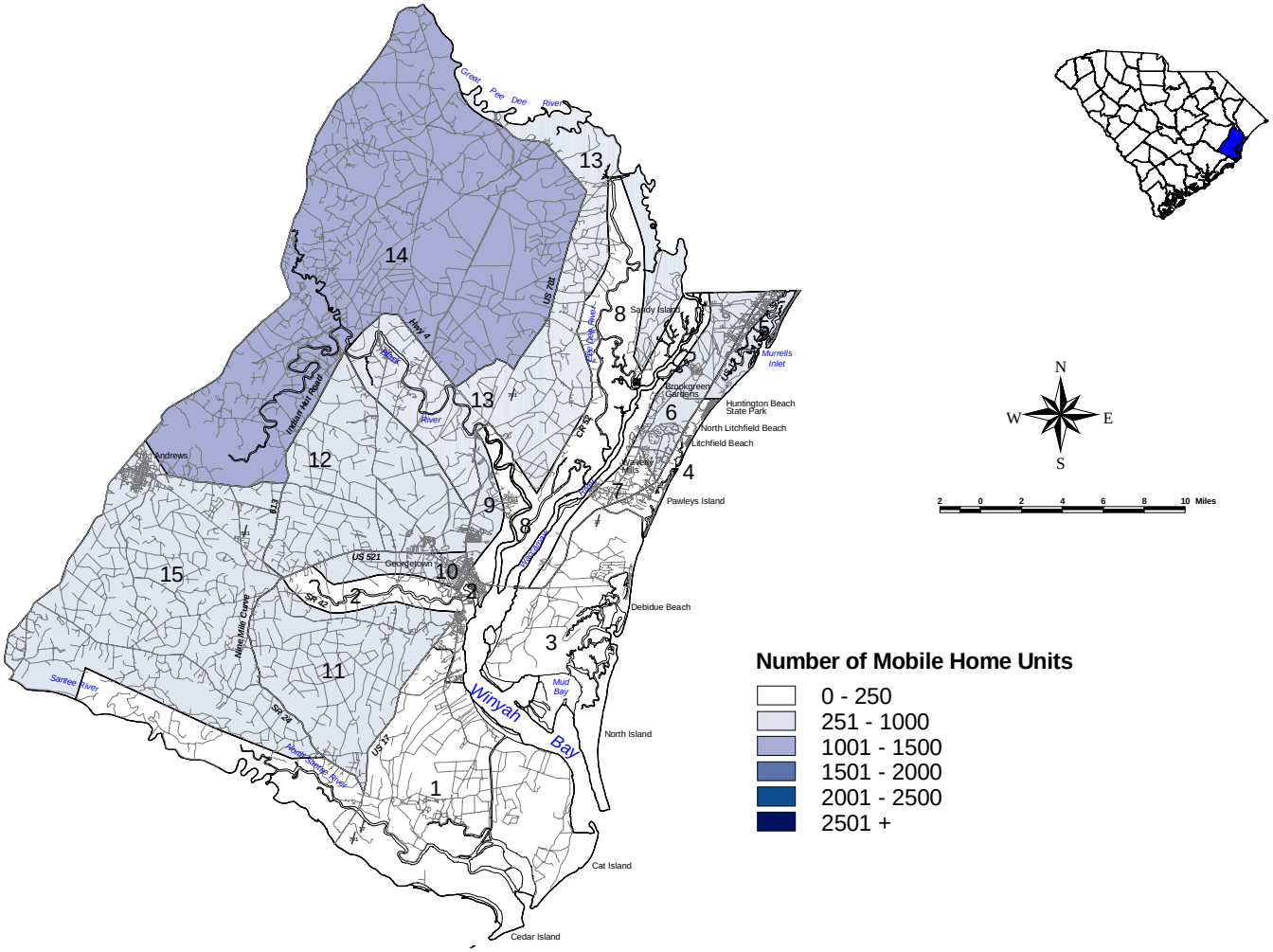
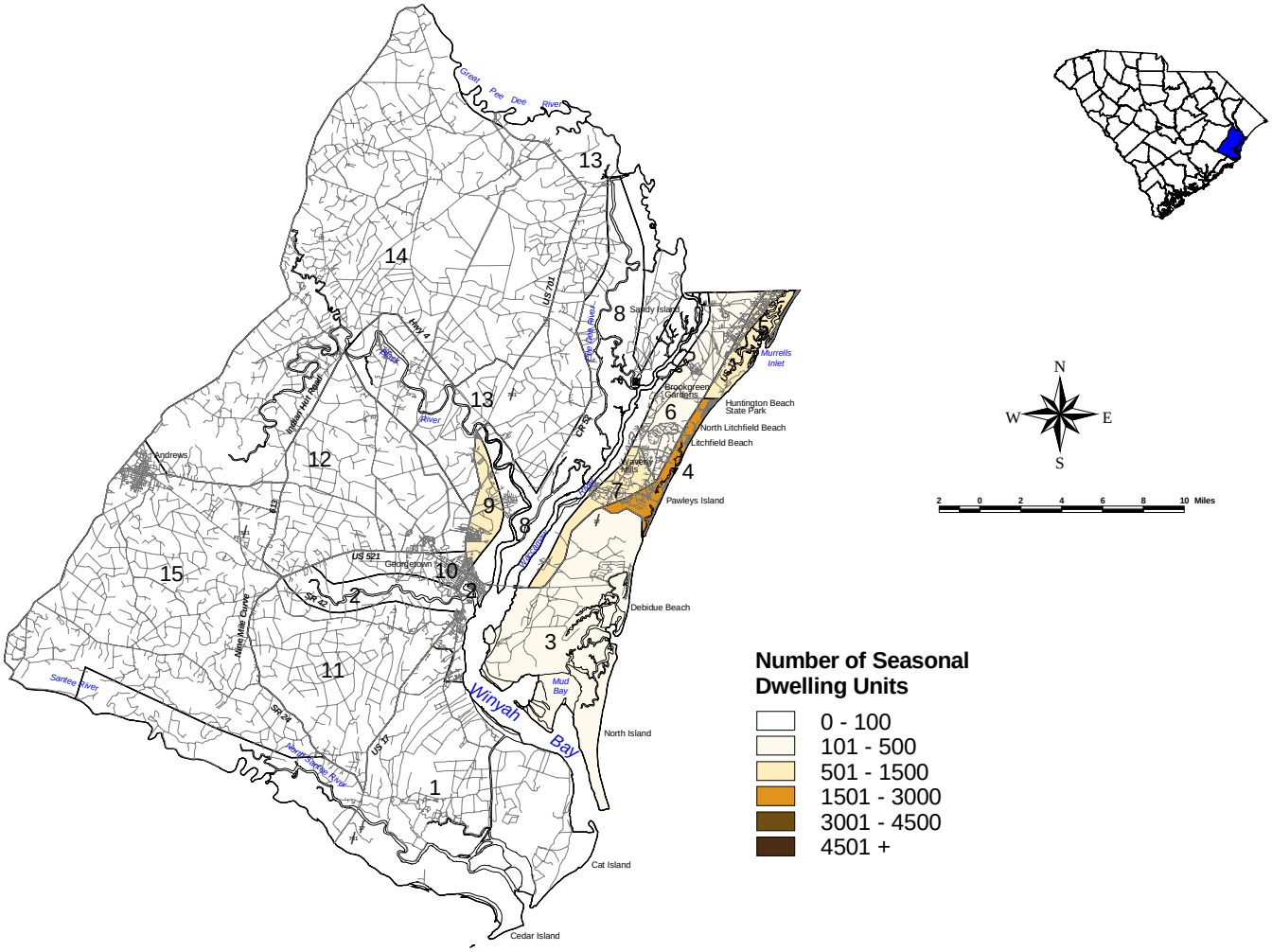


Figure 3-15. Mobile Home Units, Georgetown County

Seasonal Dwelling Units

Georgetown County

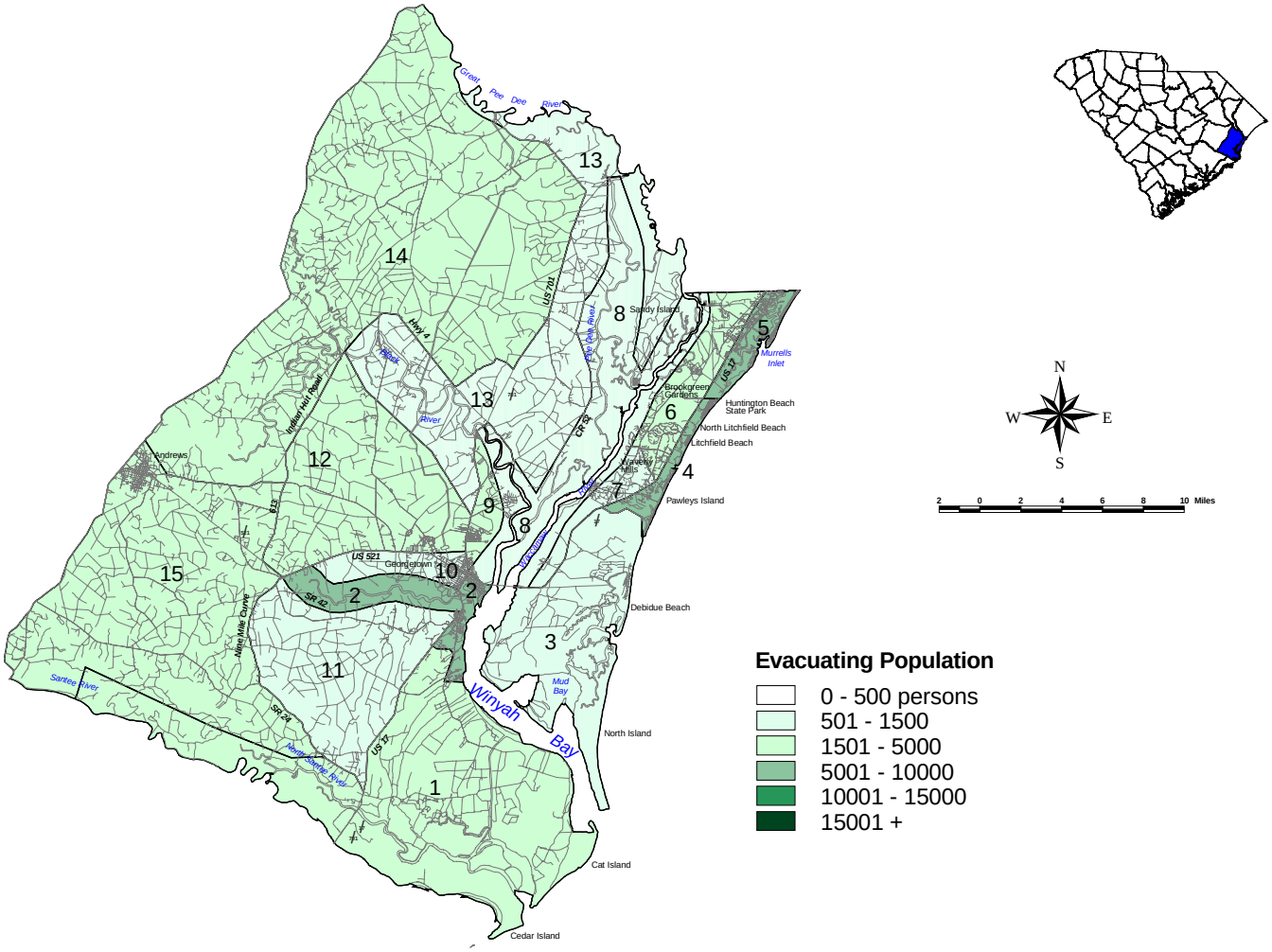


South Carolina Hurricane Evacuation Restudy

Figure 3-16. Seasonal Dwelling Units, Georgetown County

Evacuating Population

Category 1-2 Hurricane - Low Tourist Occupancy
Georgetown County

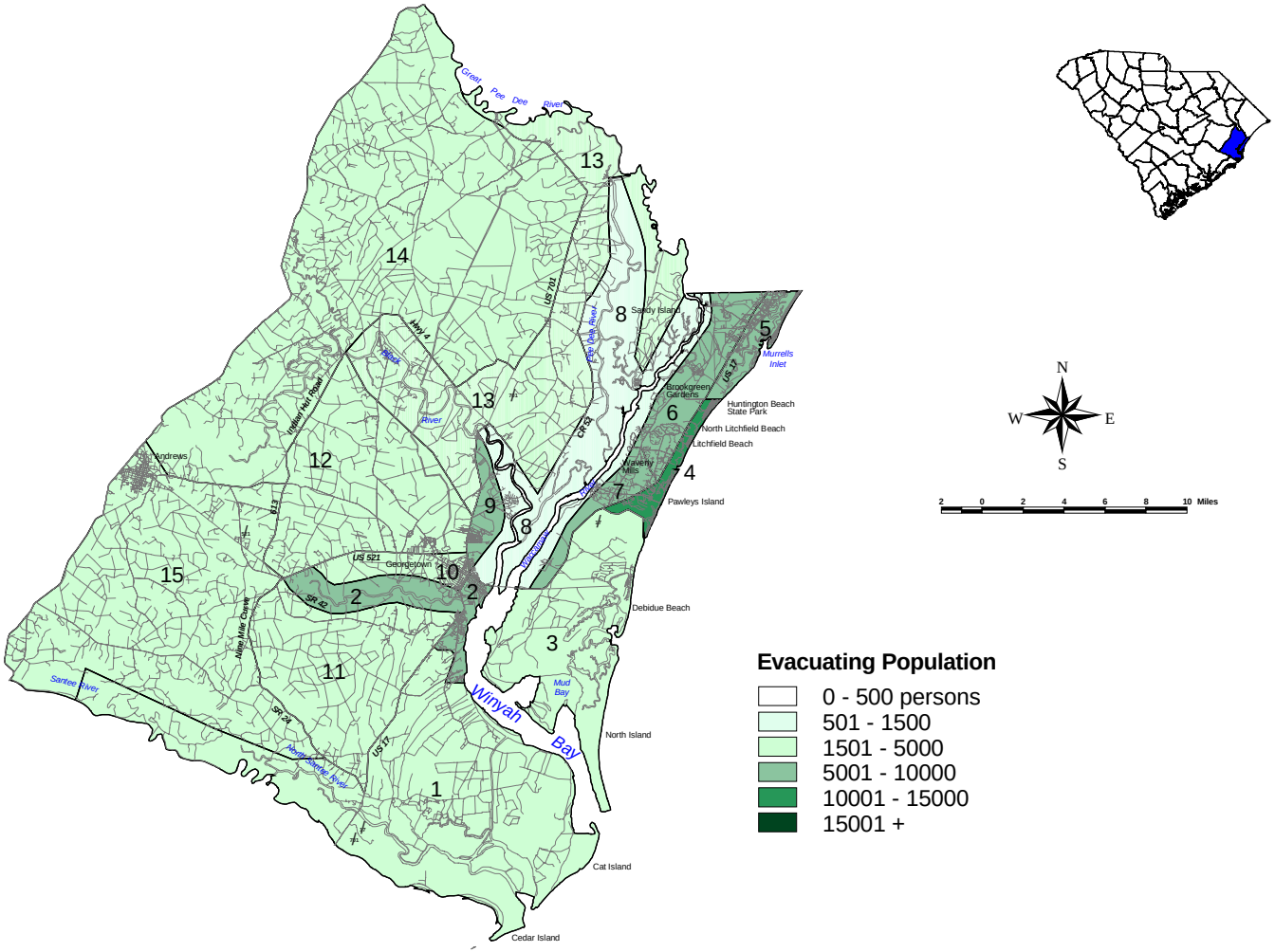


South Carolina Hurricane Evacuation Restudy

Figure 3-17. Category 1-2 Hurricane Low Tourist Occupancy, Georgetown County

Evacuating Population

Category 4-5 Hurricane - High Tourist Occupancy
Georgetown County



South Carolina Hurricane Evacuation Restudy

Figure 3-18. Category 4-5 Hurricane High Tourist Occupancy, Georgetown County

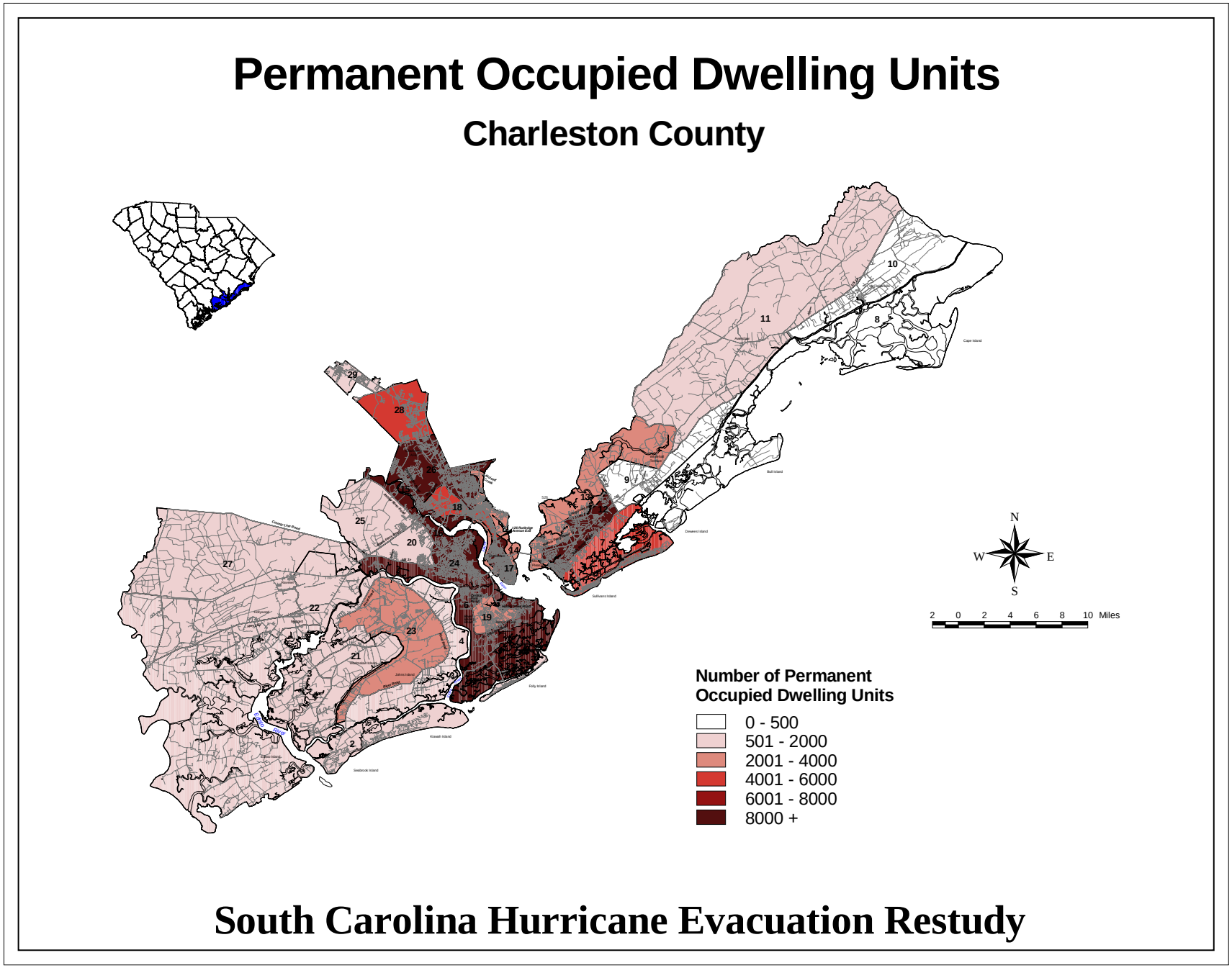


Figure 3-19. Permanent Occupied Dwelling Units, Charleston County

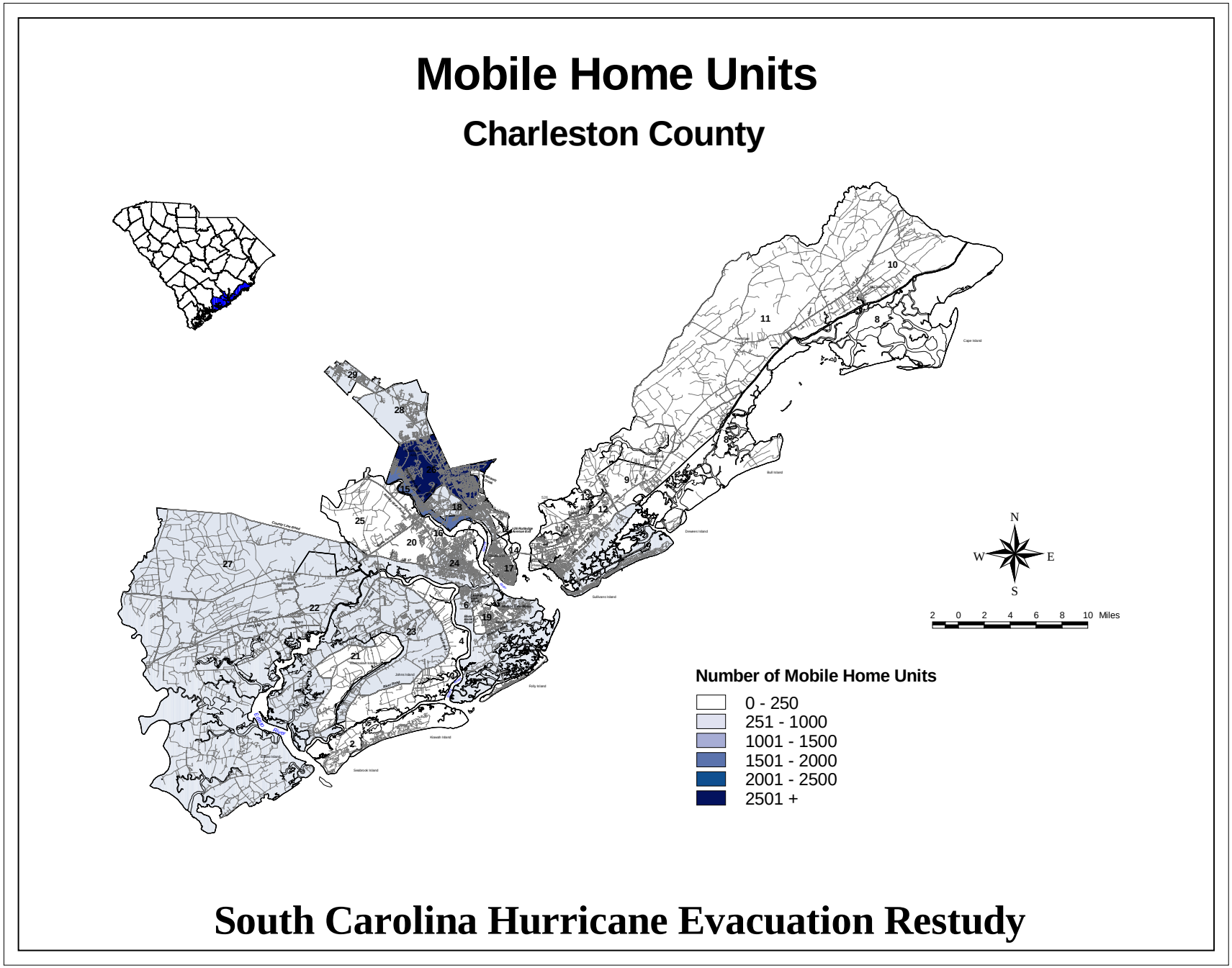


Figure 3-20. Mobile Home Units, Charleston County

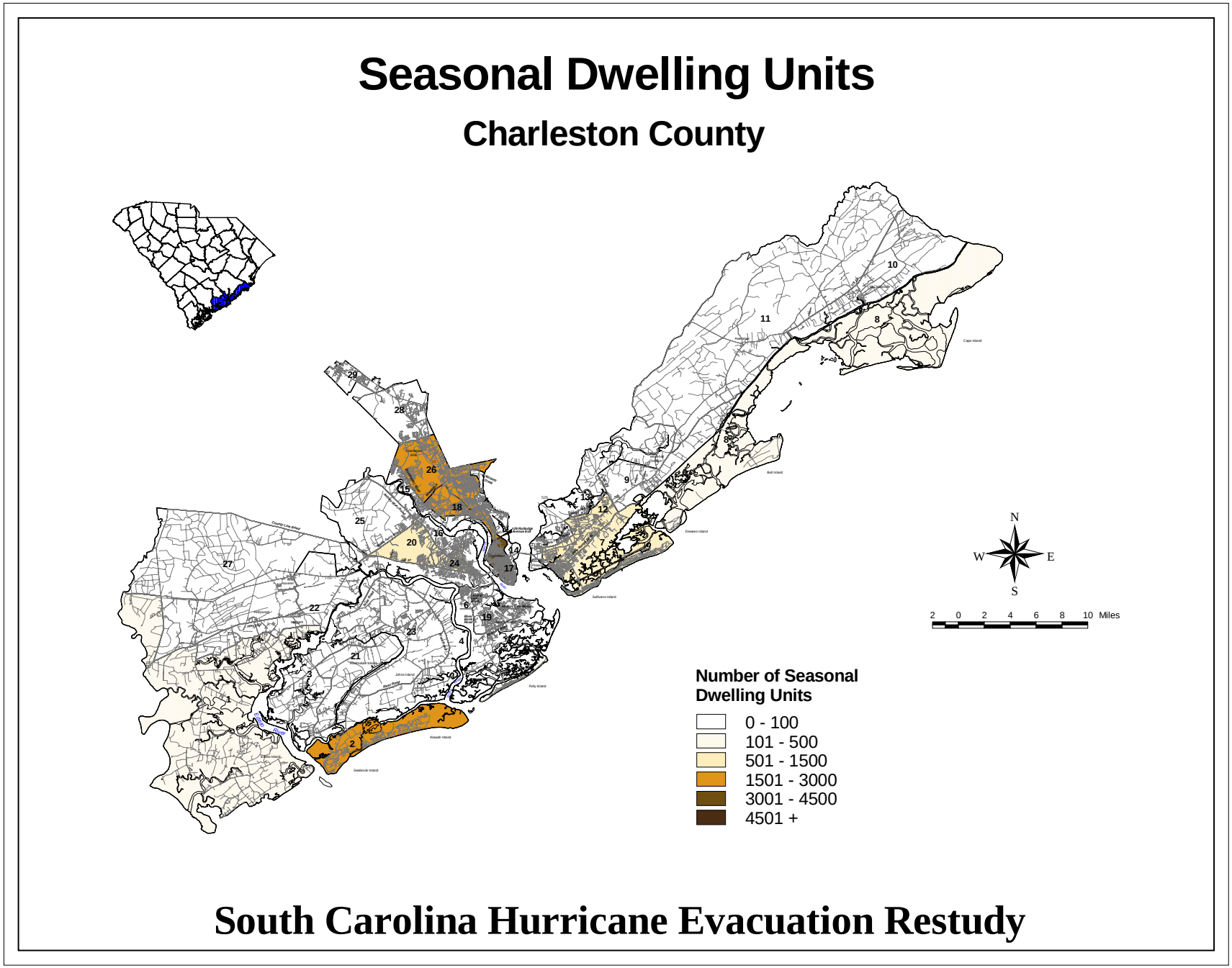


Figure 3-21. Seasonal Dwelling Units, Charleston County

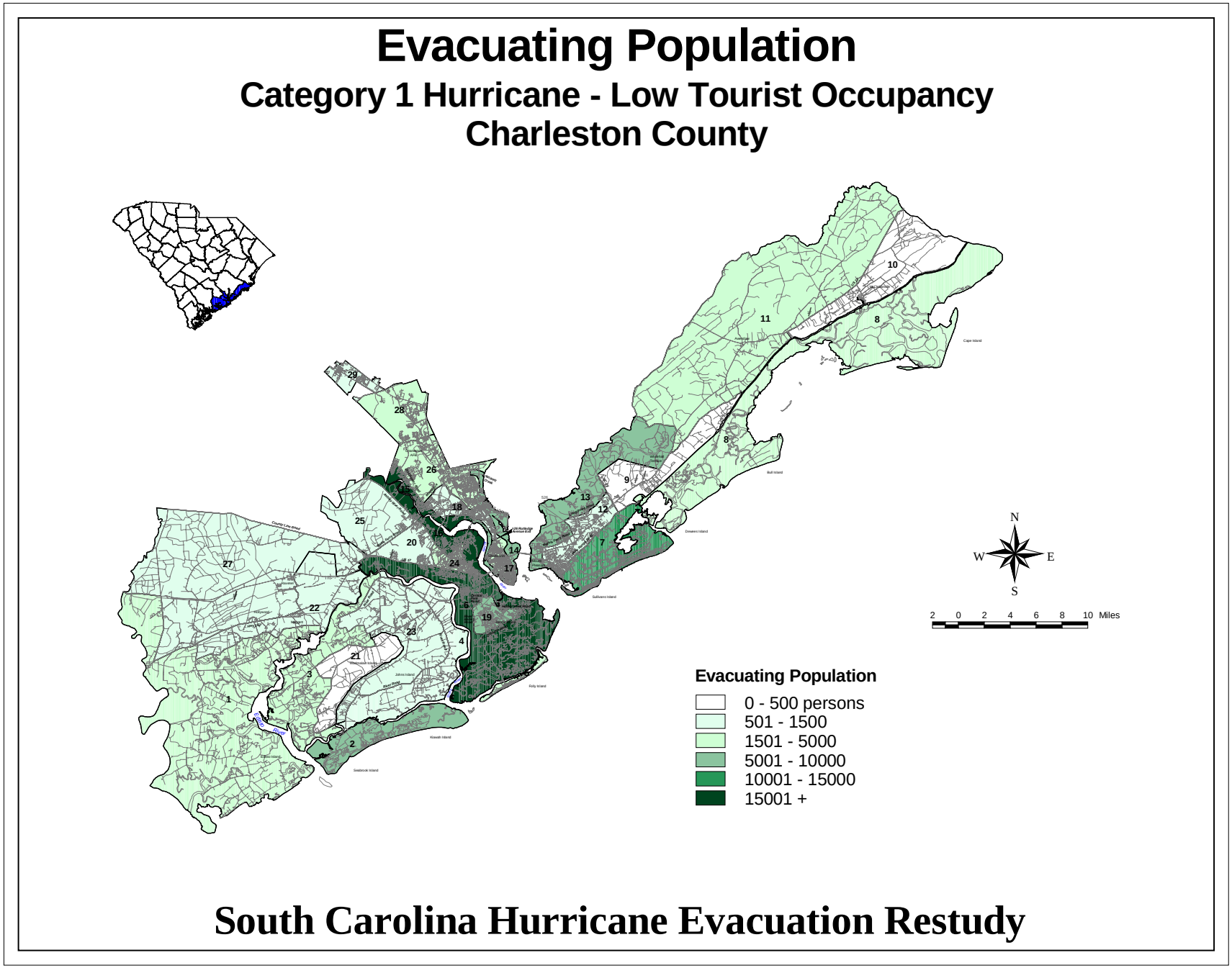


Figure 3-22. Category 1 Hurricane Low Tourist Occupancy, Charleston County

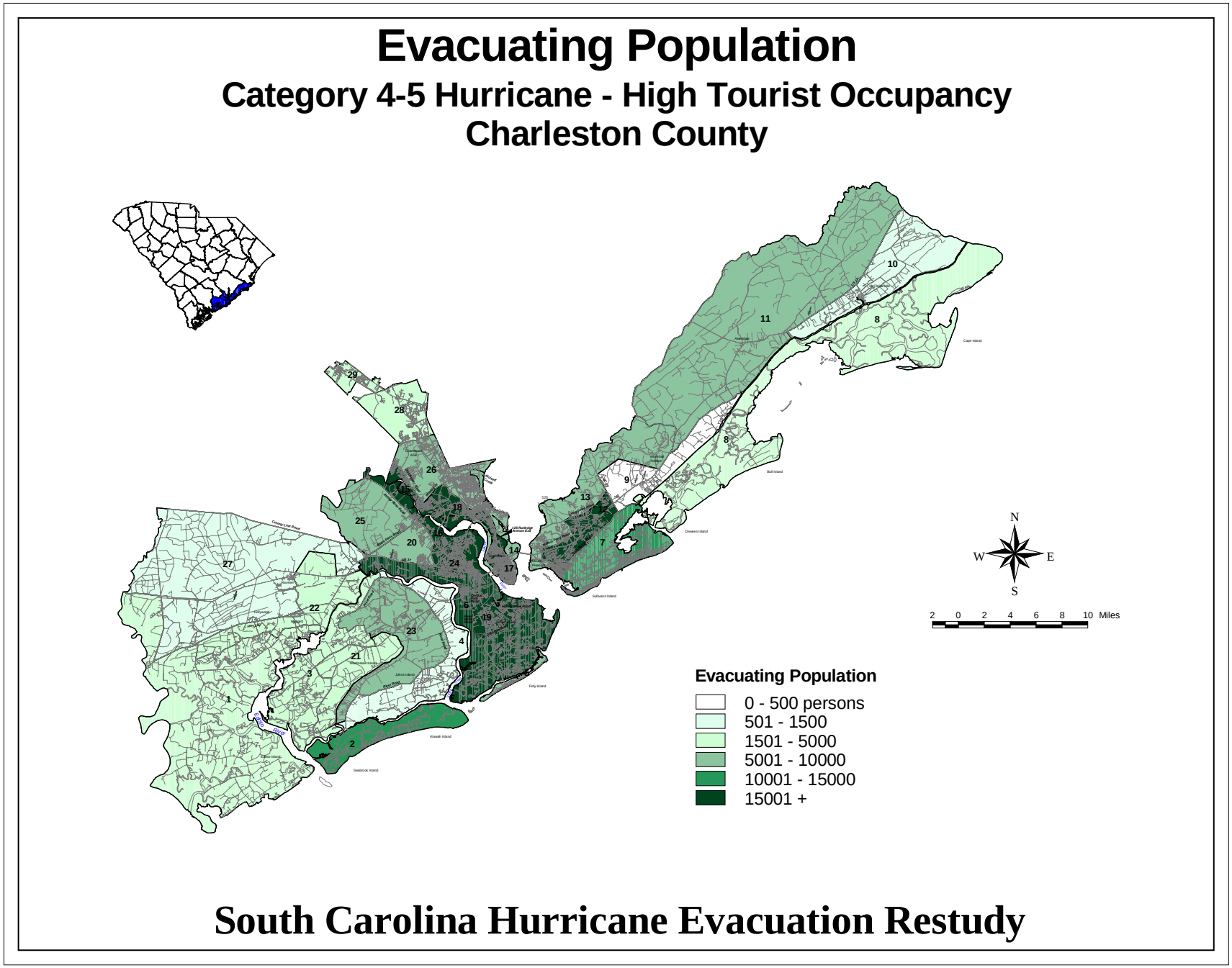


Figure 3-23. Category 4-5 Hurricane High Tourist Occupancy, Charleston County

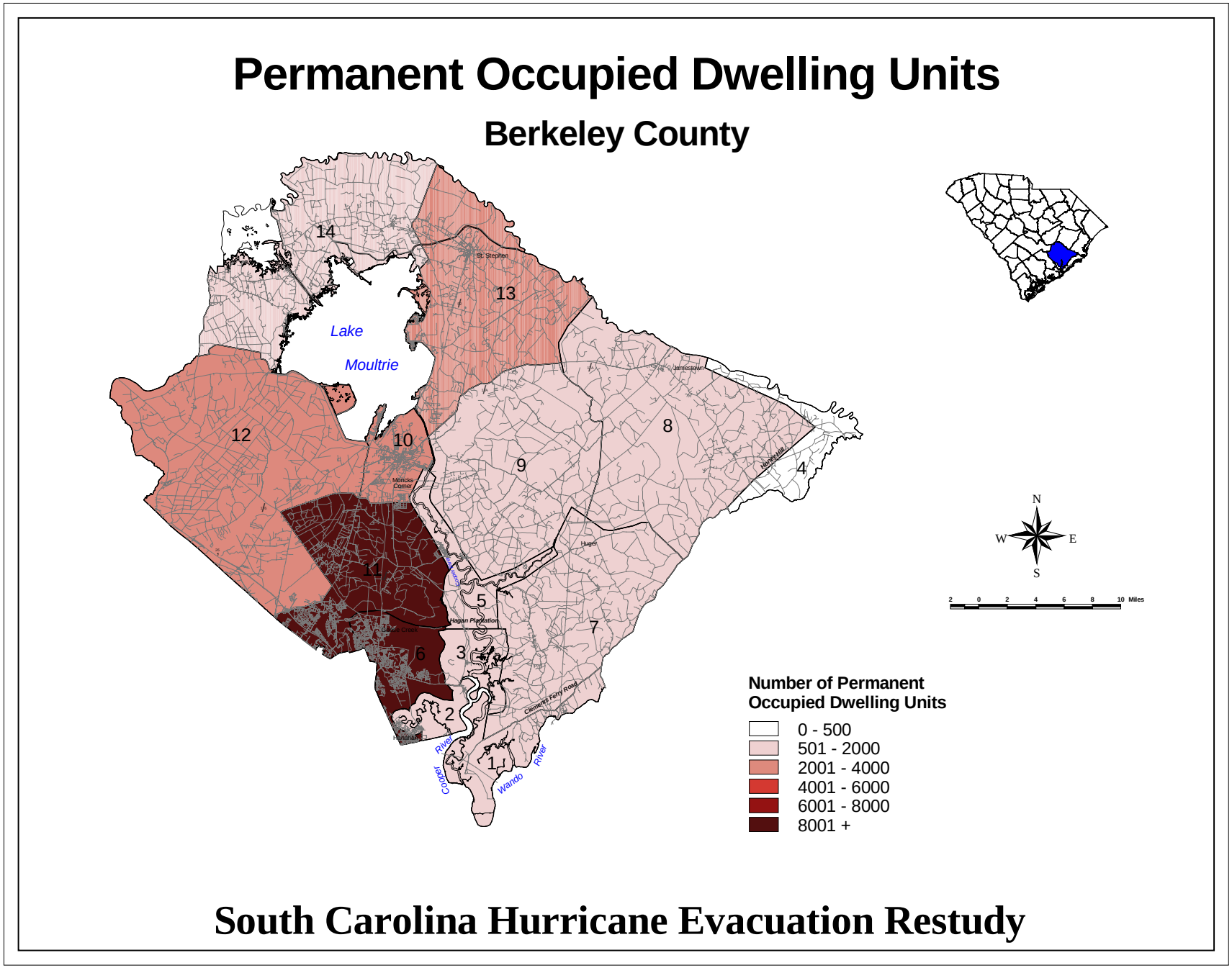


Figure 3-24. Permanent Occupied Dwelling Units, Berkeley County

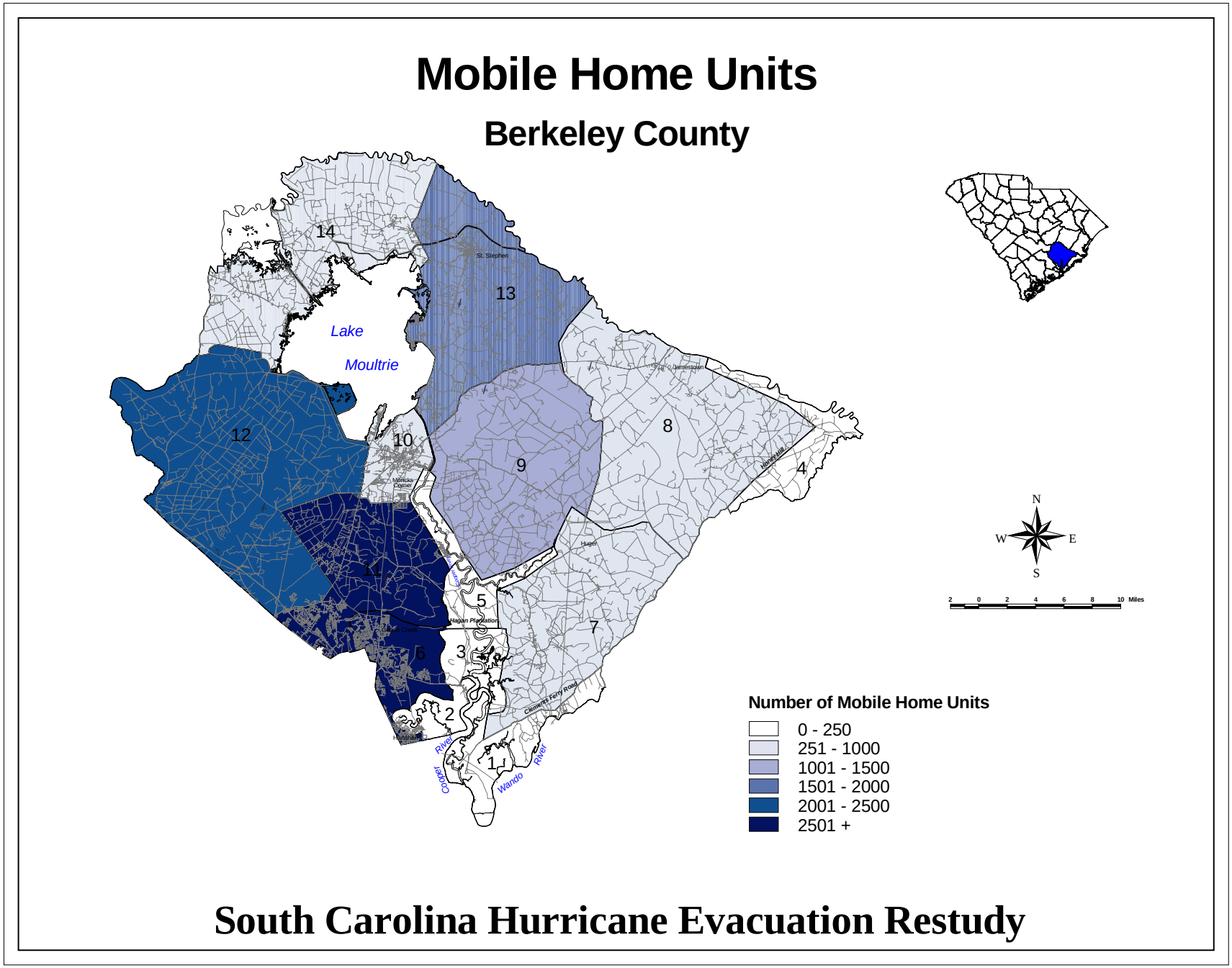


Figure 3-25. Mobile home Units, Berkeley County

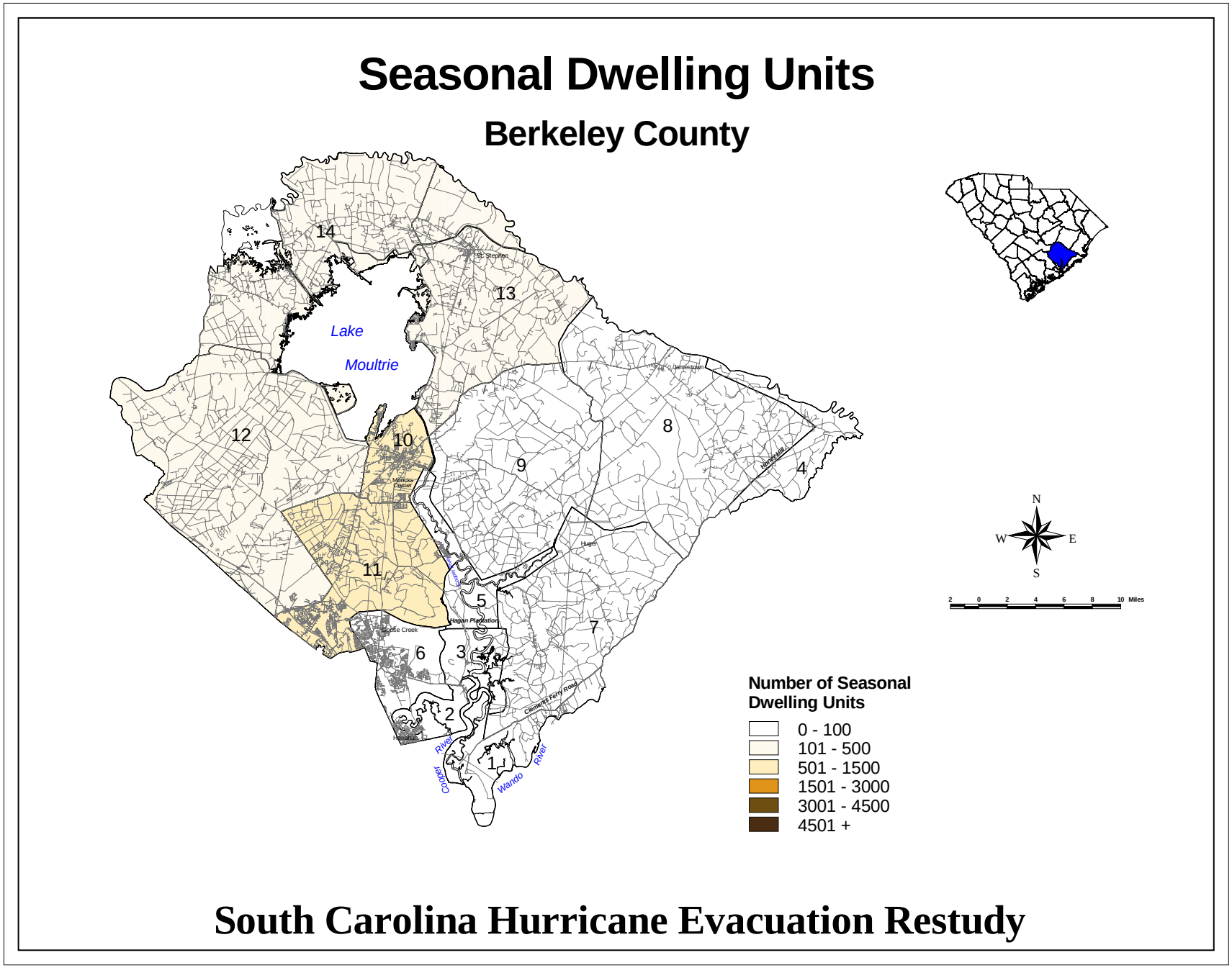


Figure 3-26. Seasonal Units, Berkeley County

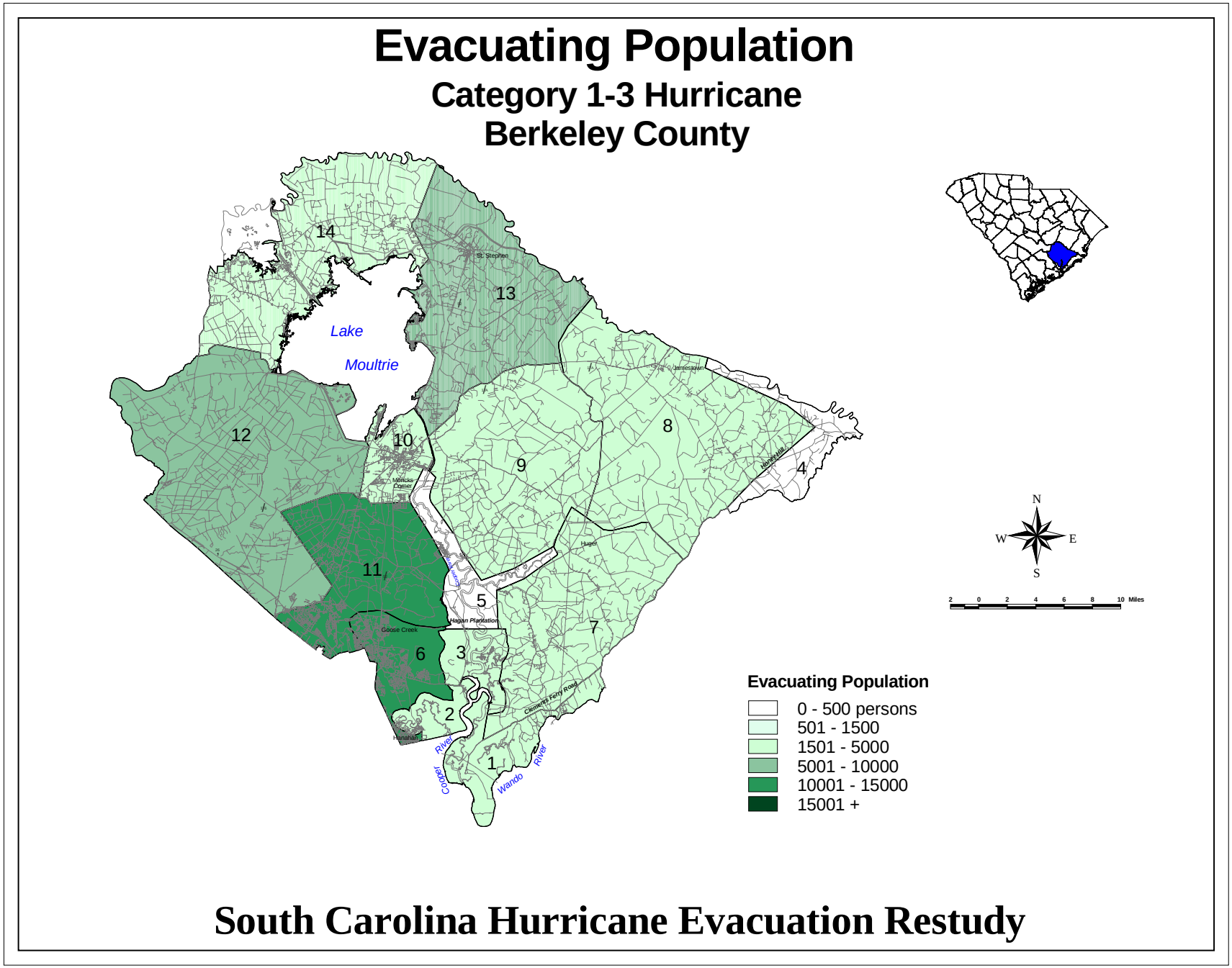


Figure 3-27. Evacuating Population Category 1-3 Hurricane, Berkeley County

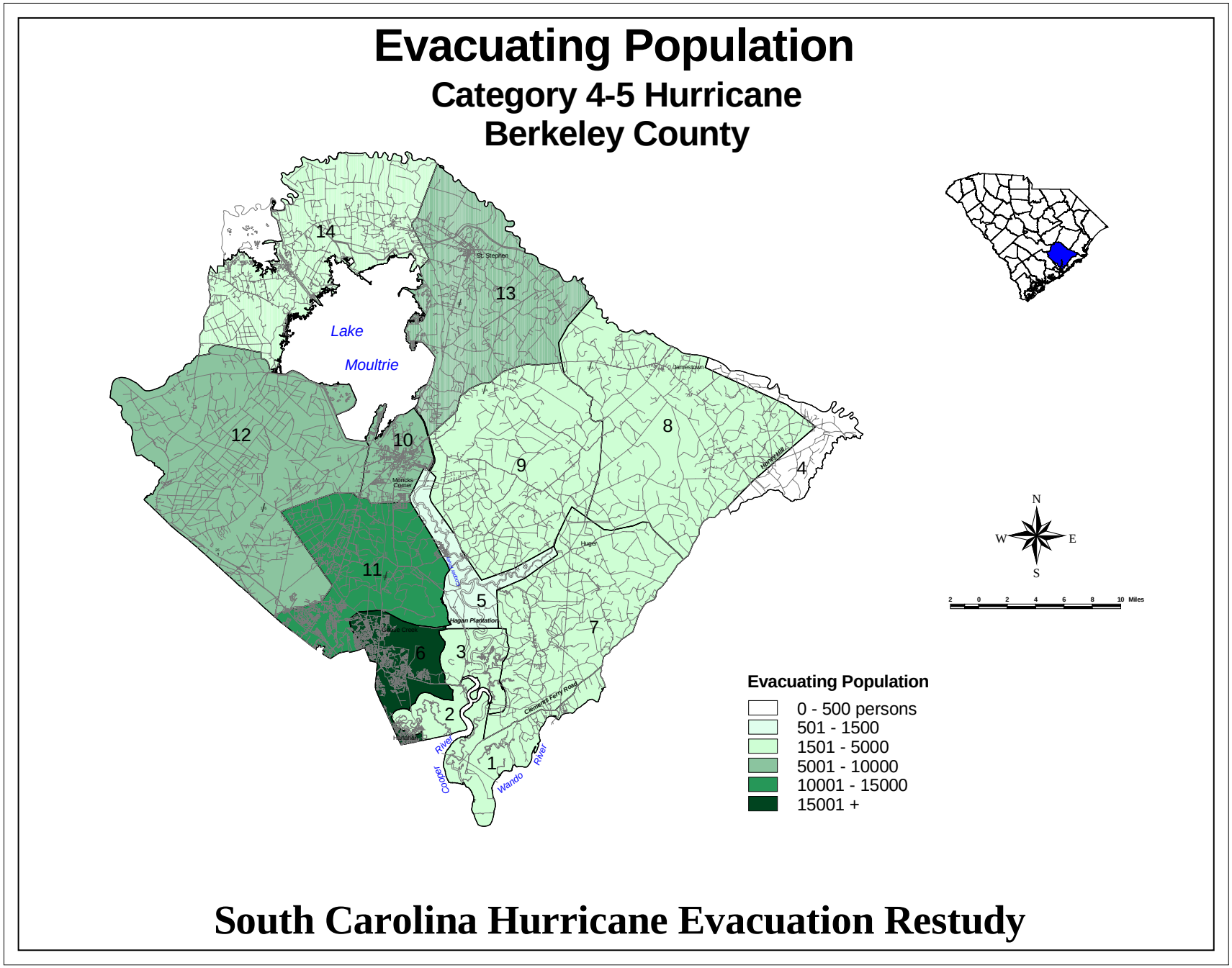


Figure 3-28. Evacuating Population Category 4-5 Hurricane, Berkeley County

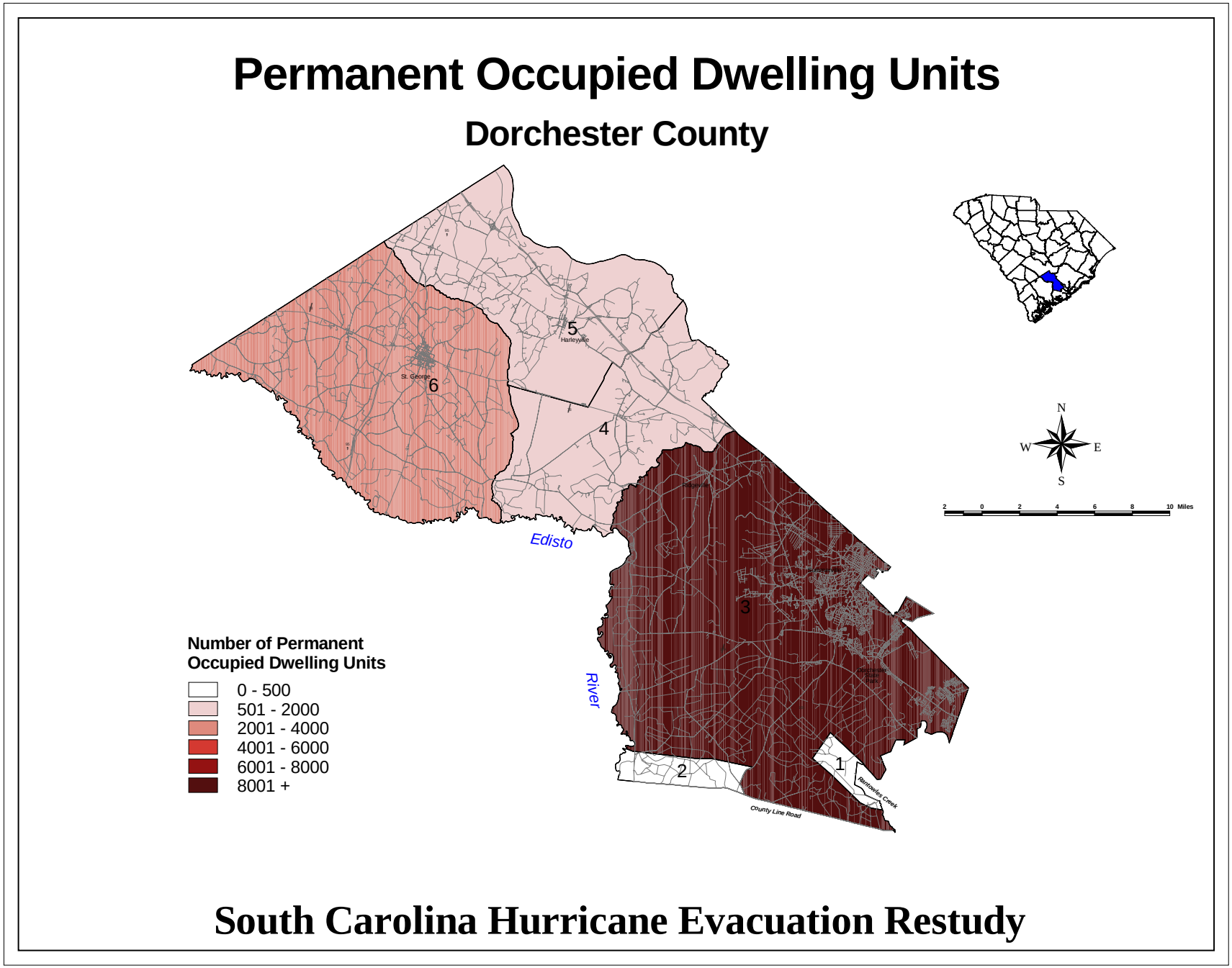


Figure 3-29. Permanent Occupied Dwelling Units, Dorchester County

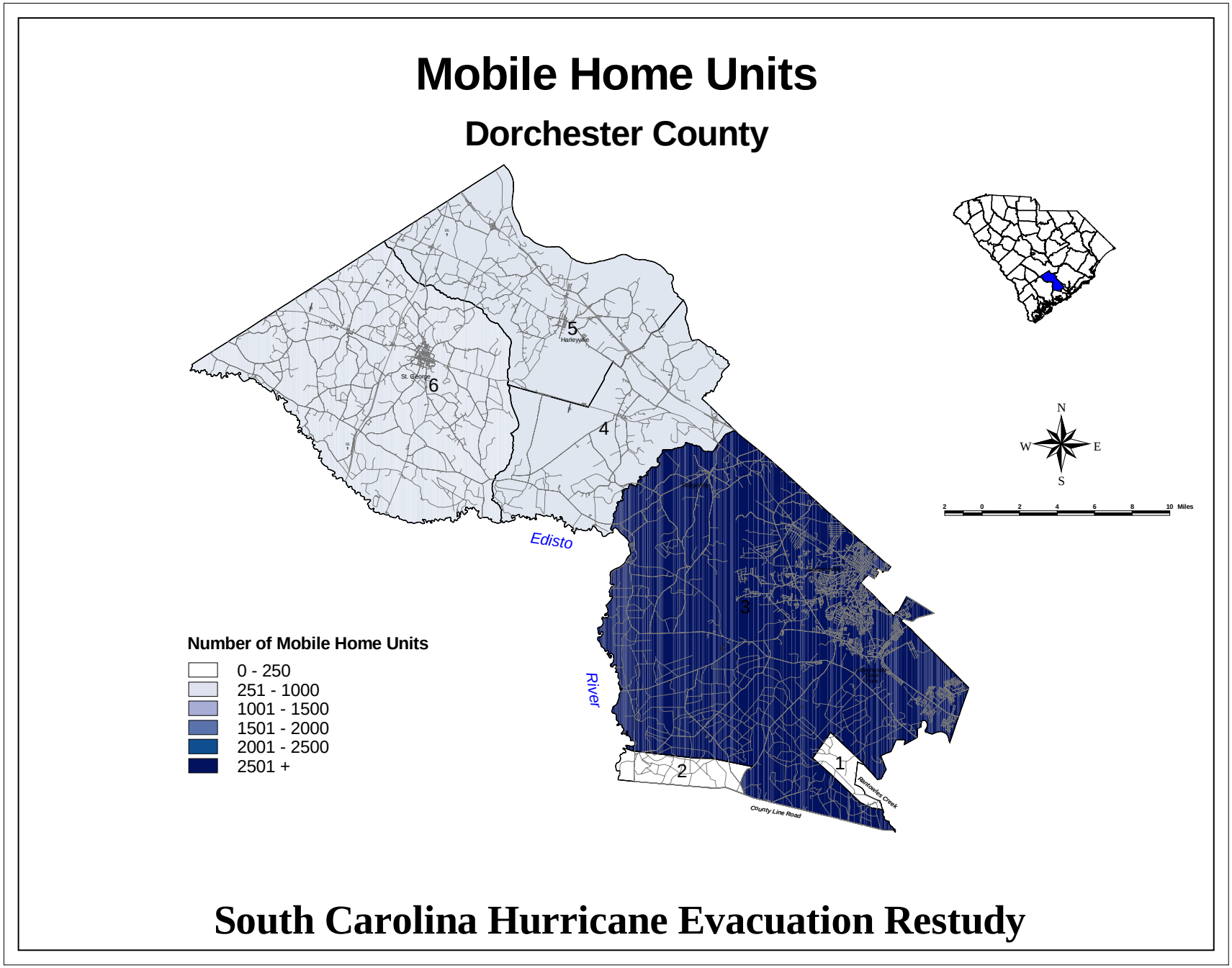


Figure 3-30. Mobile Home Units, Dorchester County

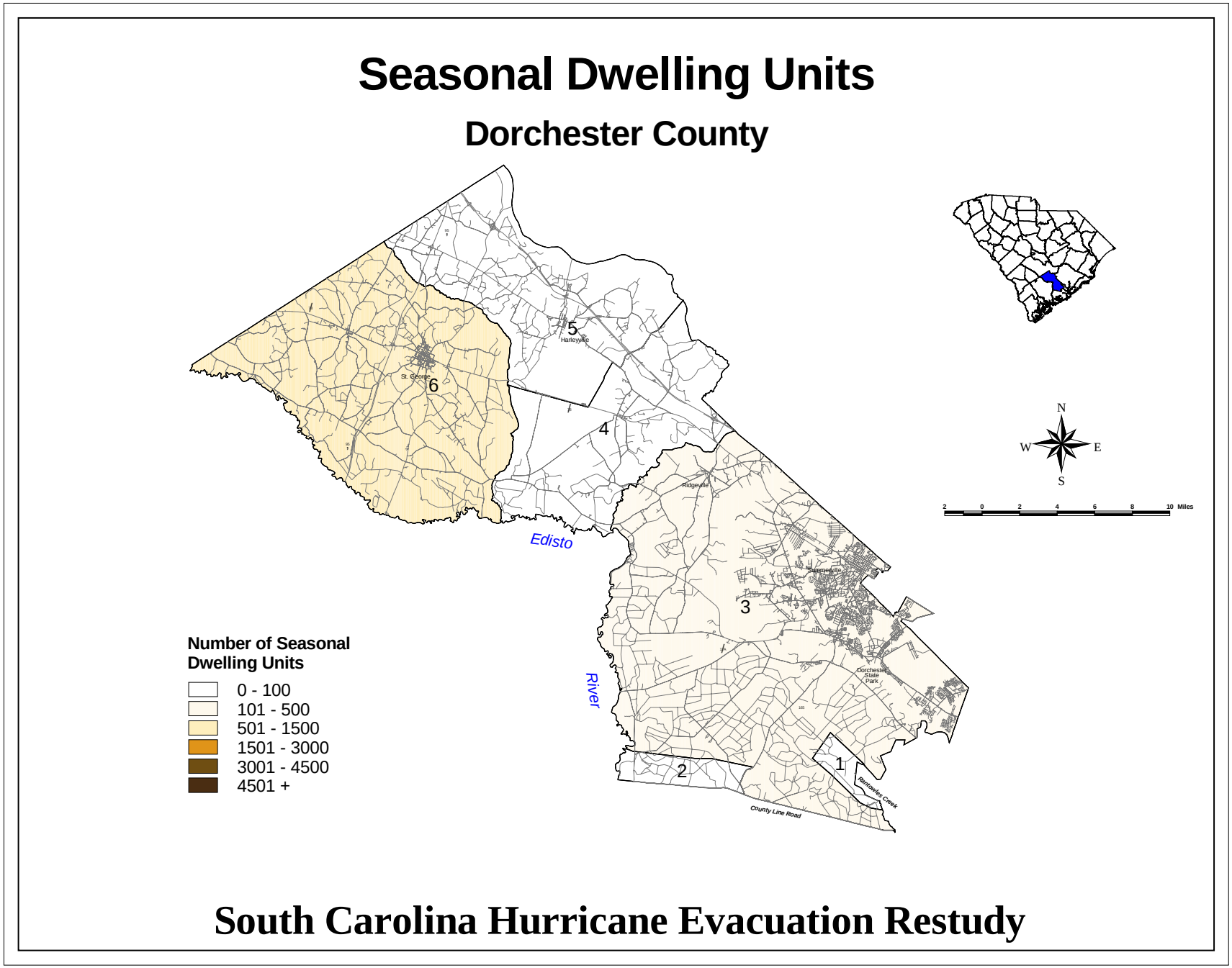


Figure 3-31. Seasonal Dwelling Units, Dorchester County

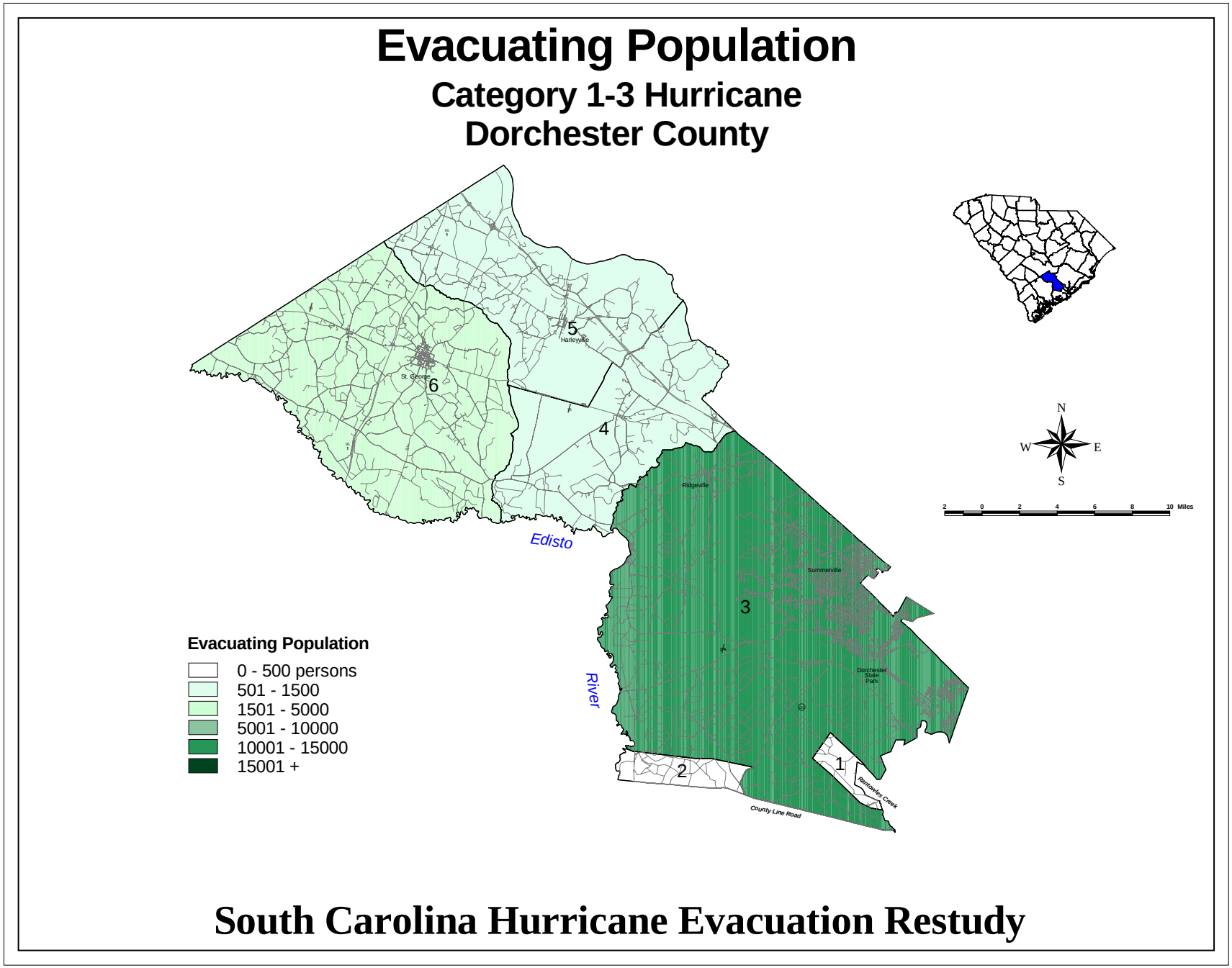


Figure 3-32. Evacuating Population Category 1-3 Hurricane, Dorchester County

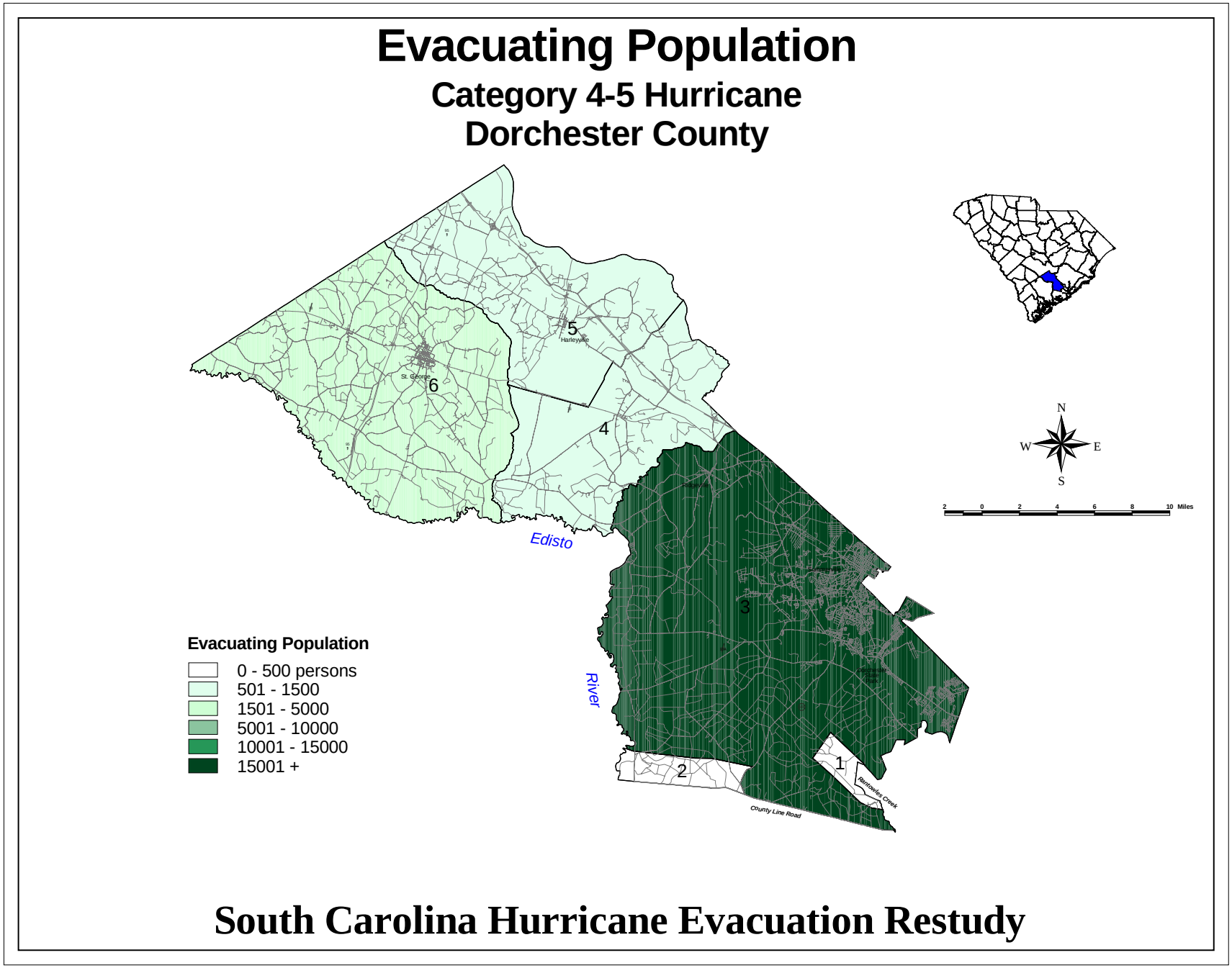
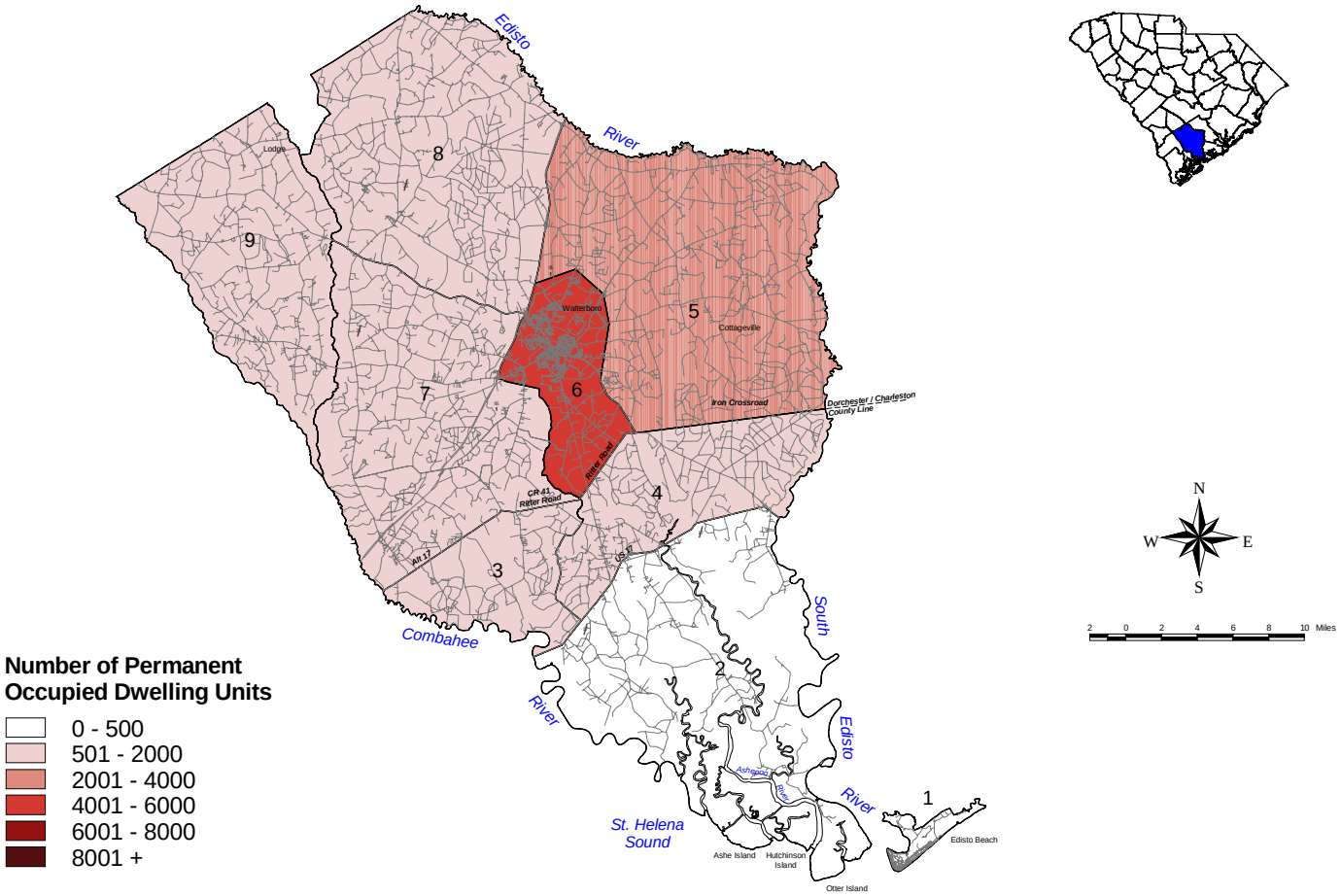


Figure 3-33. Evacuating Population Category 4-5 Hurricane, Dorchester County

Permanent Occupied Dwelling Units

Colleton County



South Carolina Hurricane Evacuation Restudy

Figure 3-34. Permanent Occupied Dwelling Units, Colleton County

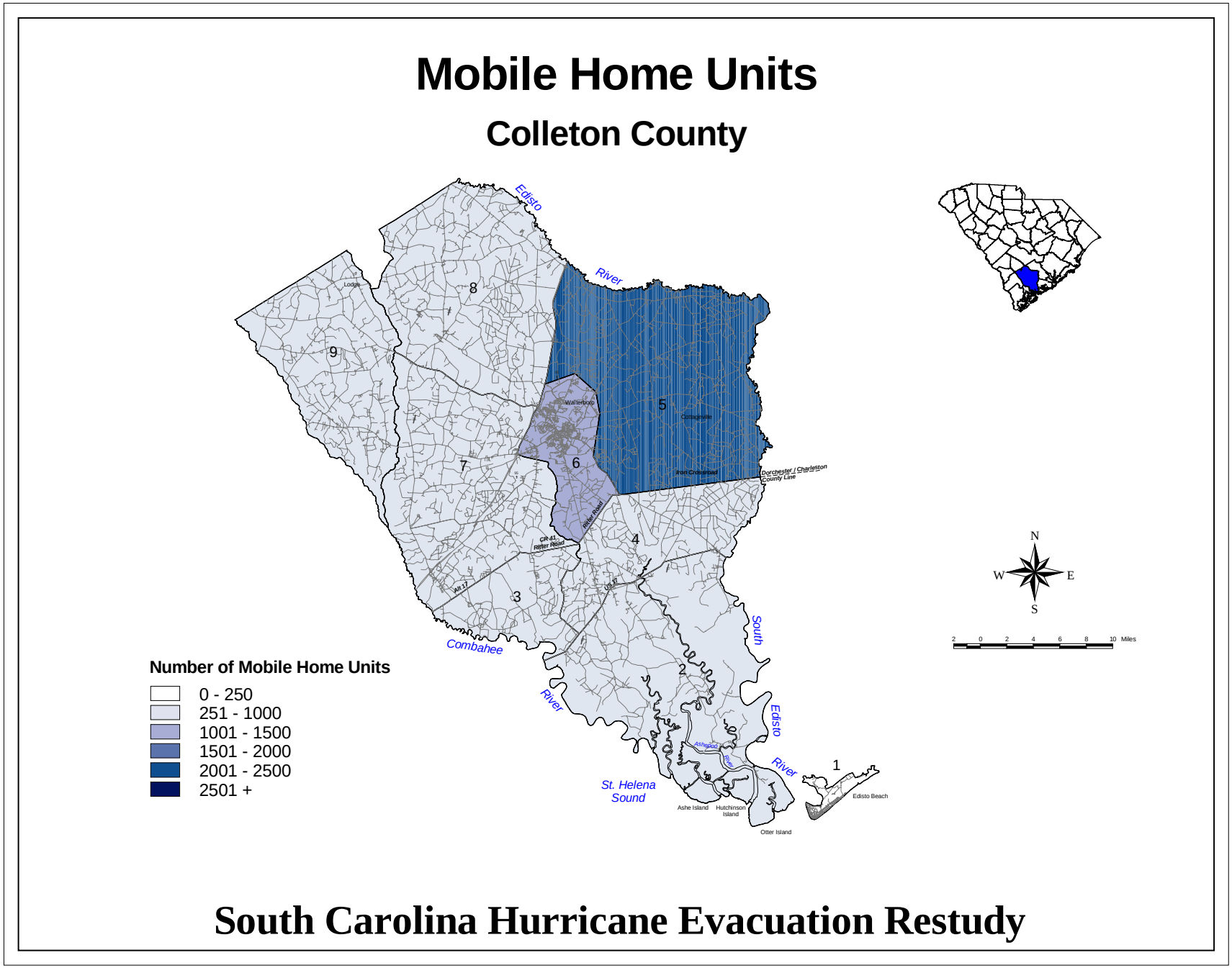


Figure 3-35. Mobile Home Units, Colleton County

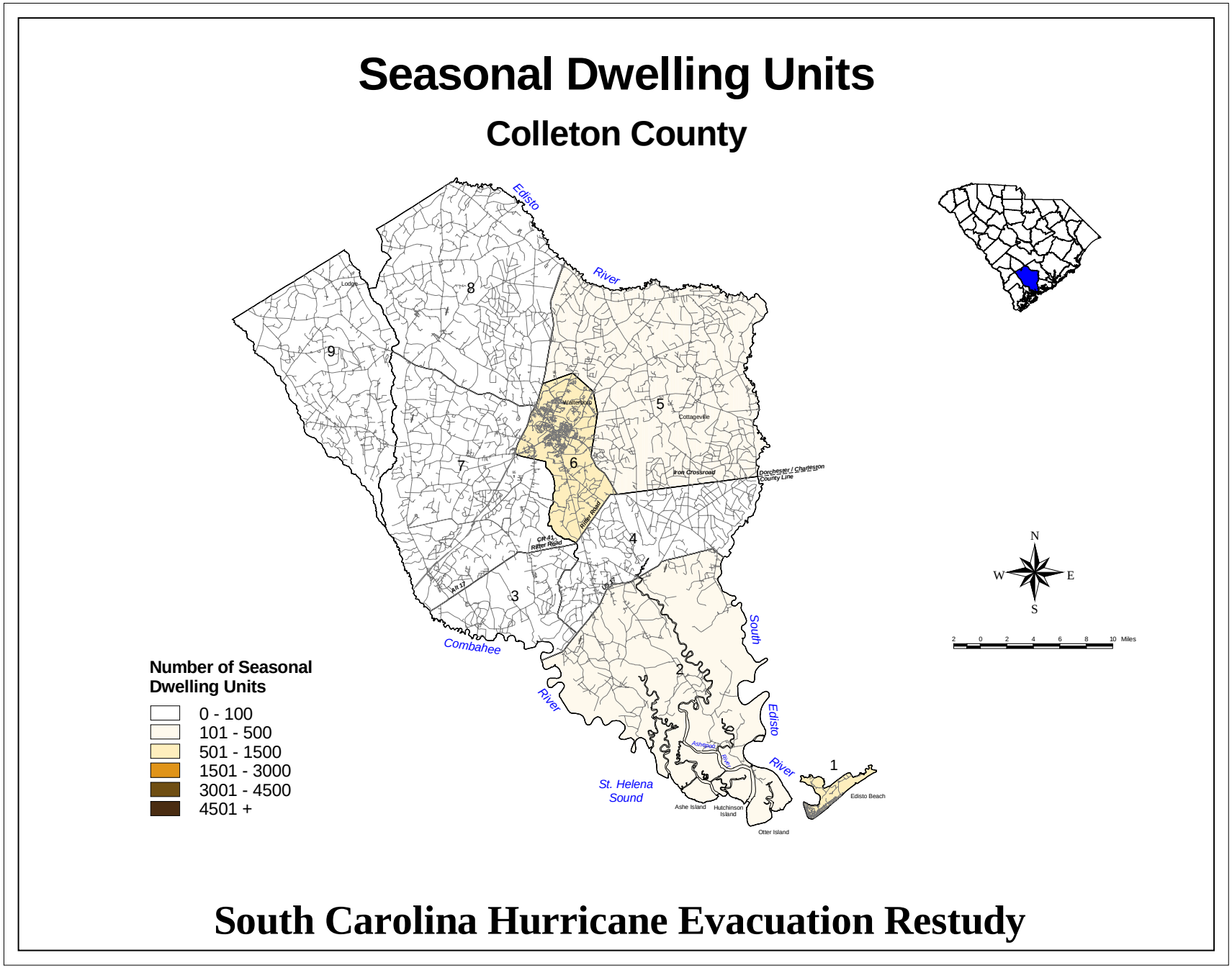


Figure 3-36. Seasonal Dwelling Units, Colleton County

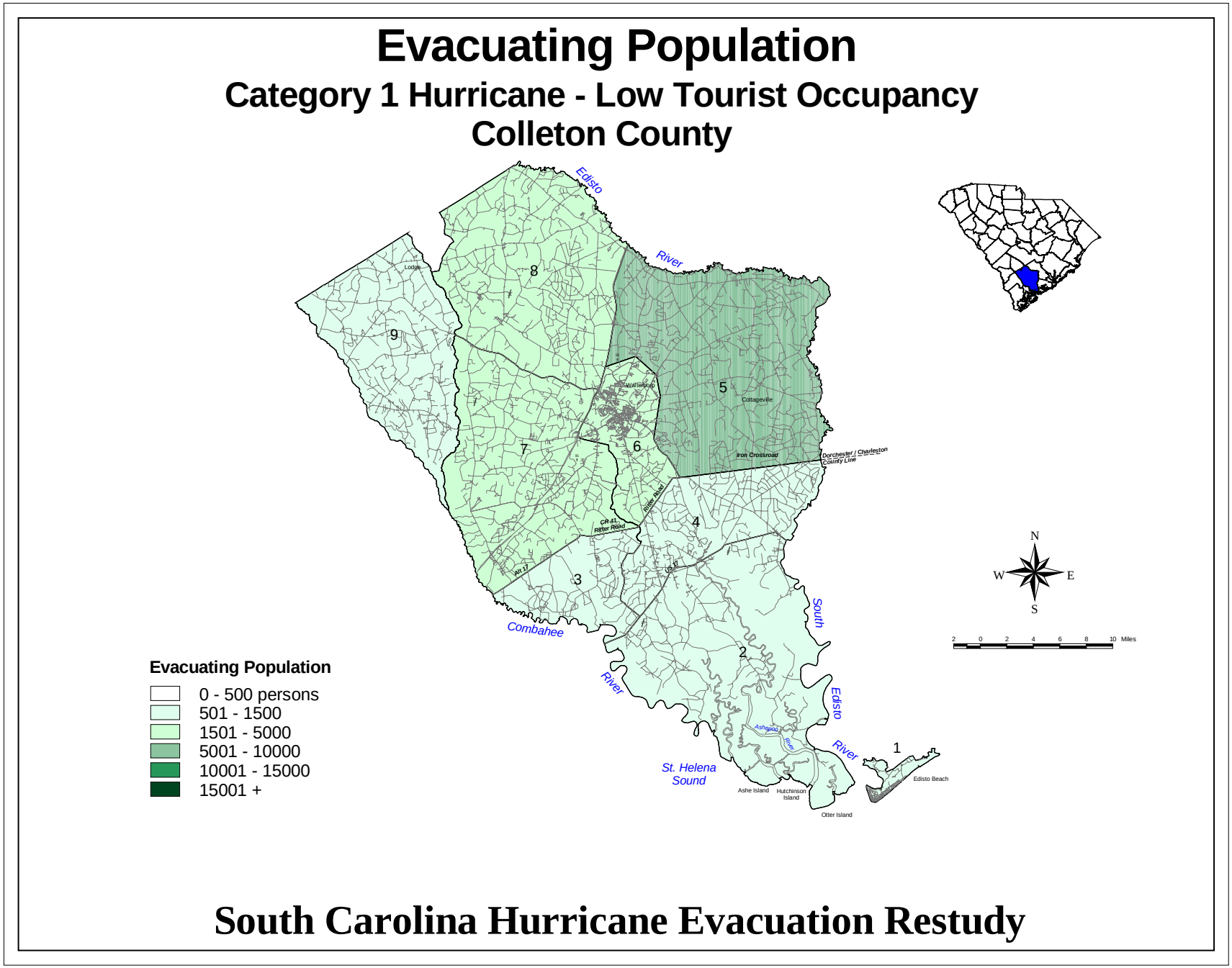


Figure 3-37. Evacuating Population Category 1 Hurricane Low Tourist Occupancy, Colleton County

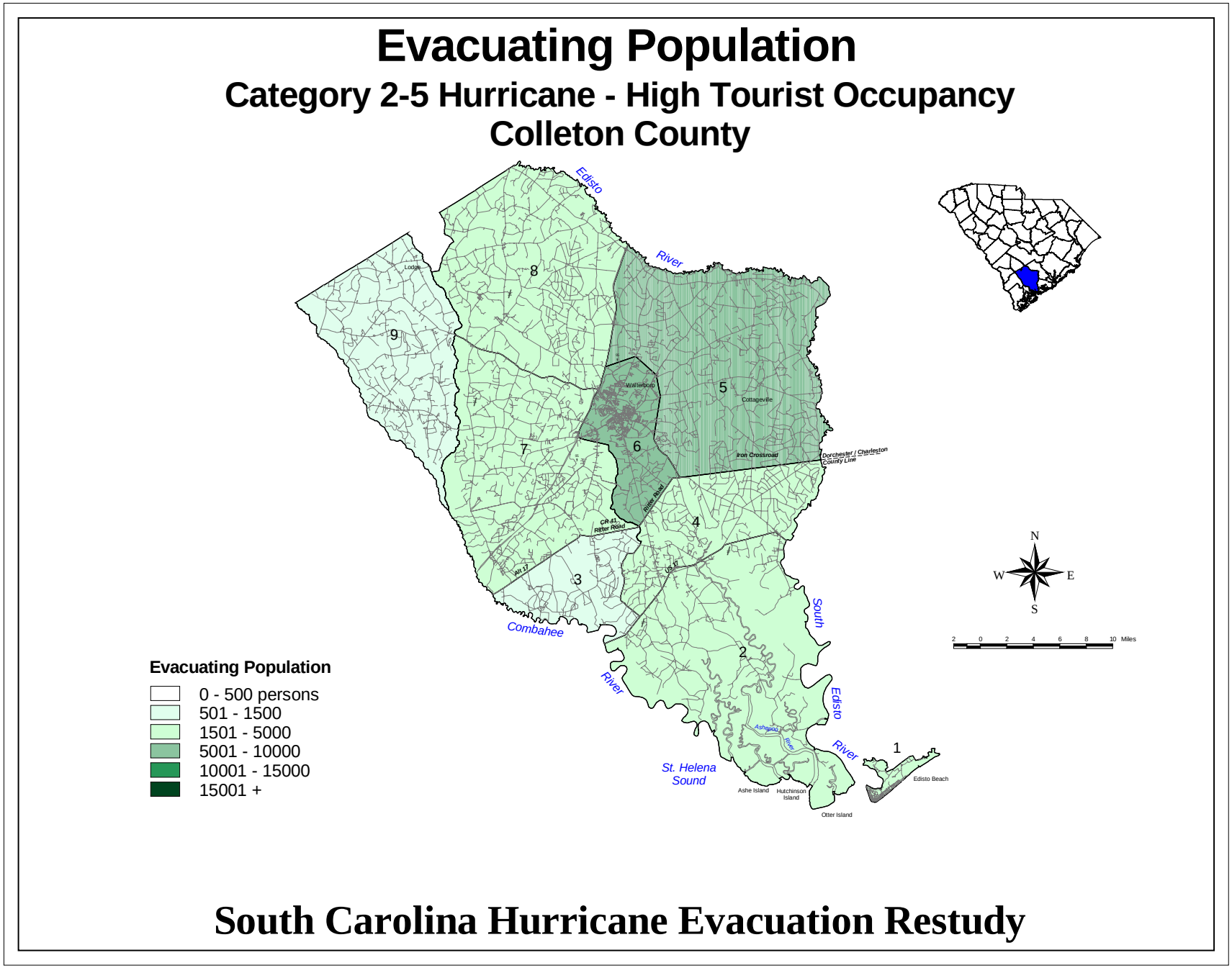


Figure 3-38. Evacuating Population Category 2-5 Hurricane High Tourist Occupancy, Colleton County

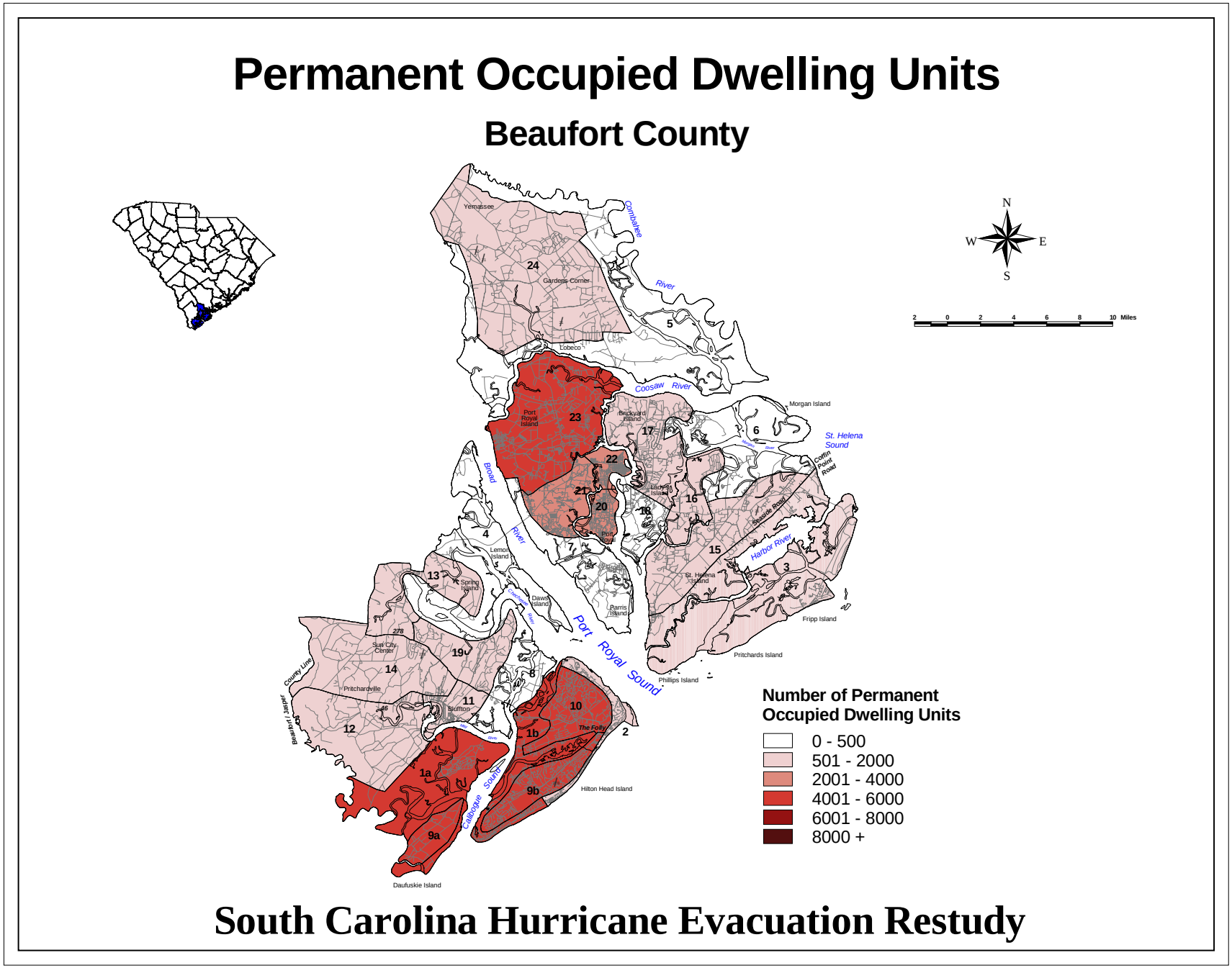
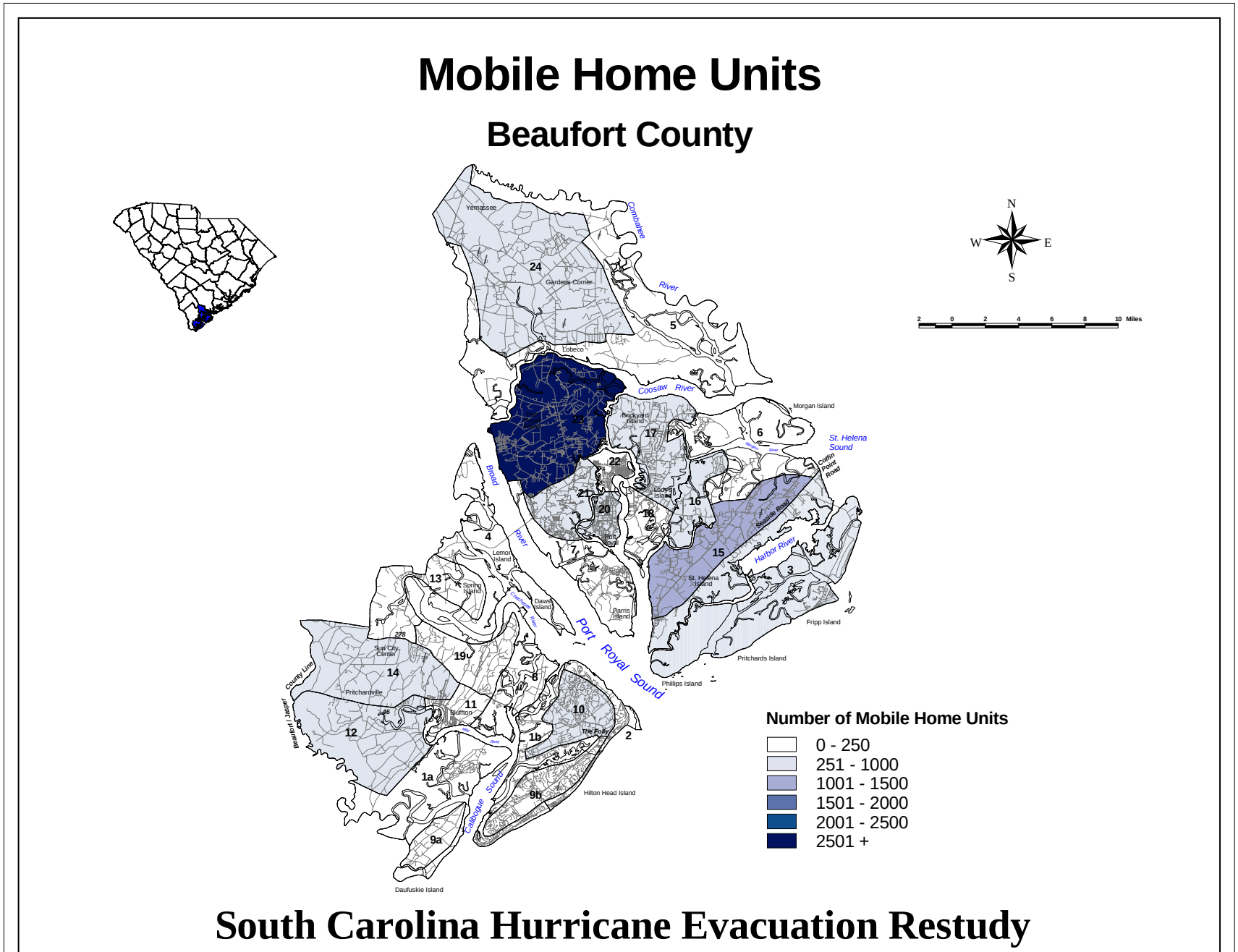
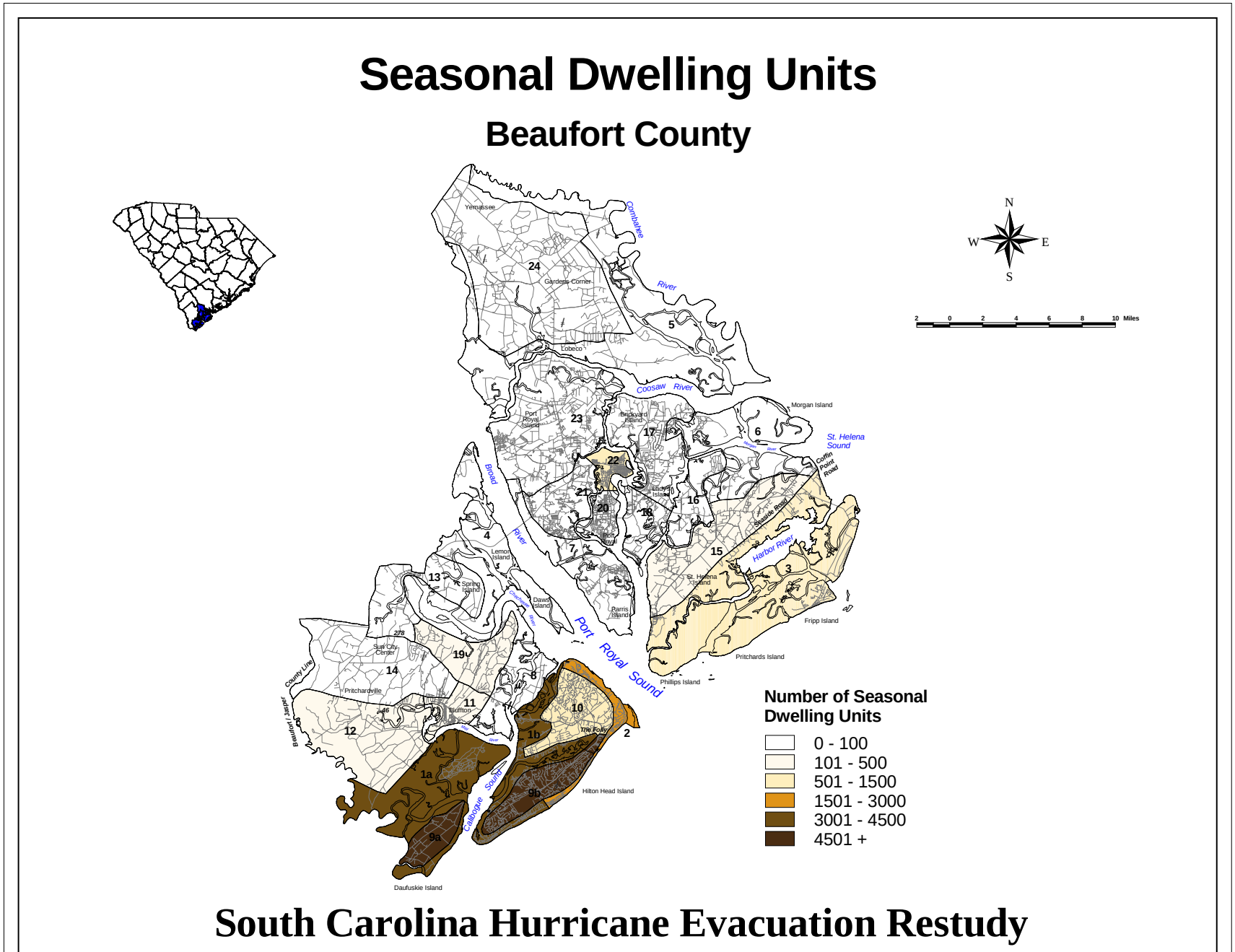


Figure 3-39. Permanent Occupied Dwelling Units, Beaufort County



South Carolina Hurricane Evacuation Restudy

Figure 3-40. Mobile Home Units, Beaufort County

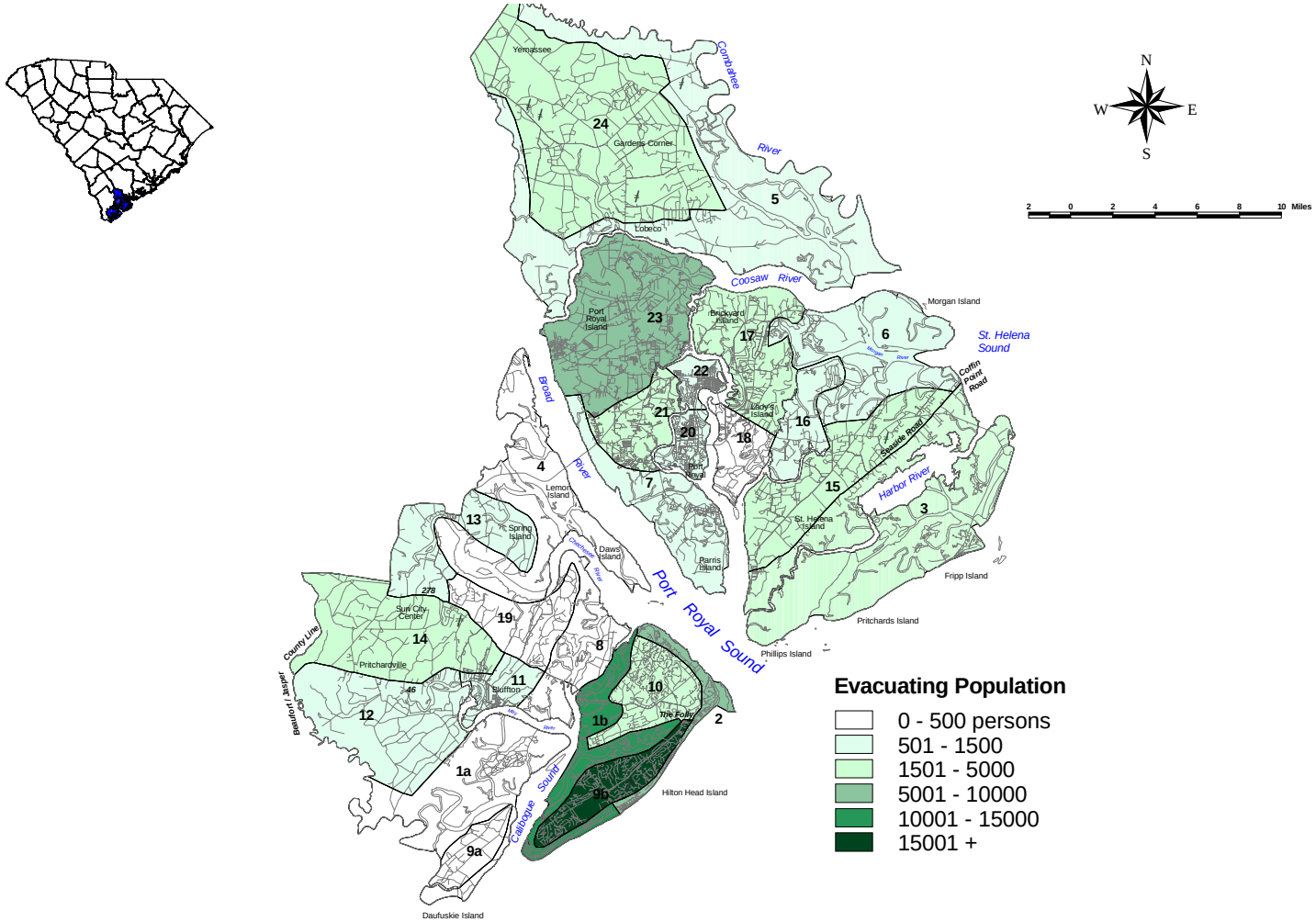


South Carolina Hurricane Evacuation Restudy

Figure 3-41. Seasonal Dwelling Units, Beaufort County

Evacuating Population

Category 1 Hurricane - Low Tourist Occupancy
Beaufort County

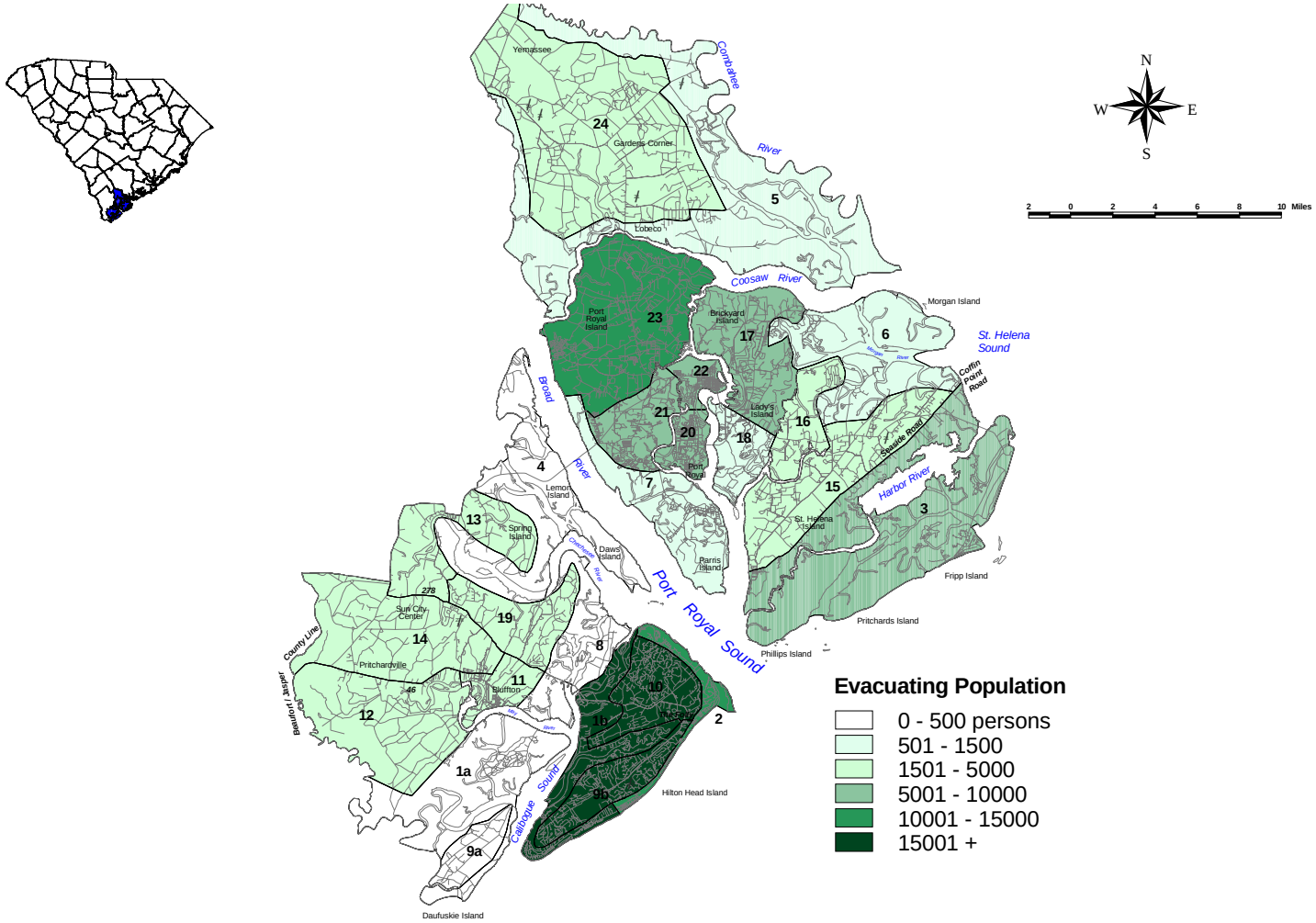


South Carolina Hurricane Evacuation Restudy

Figure 3-42. Category 1 Hurricane Low Tourist Occupancy, Beaufort County

Evacuating Population

Category 3-5 Hurricane - High Tourist Occupancy
Beaufort County

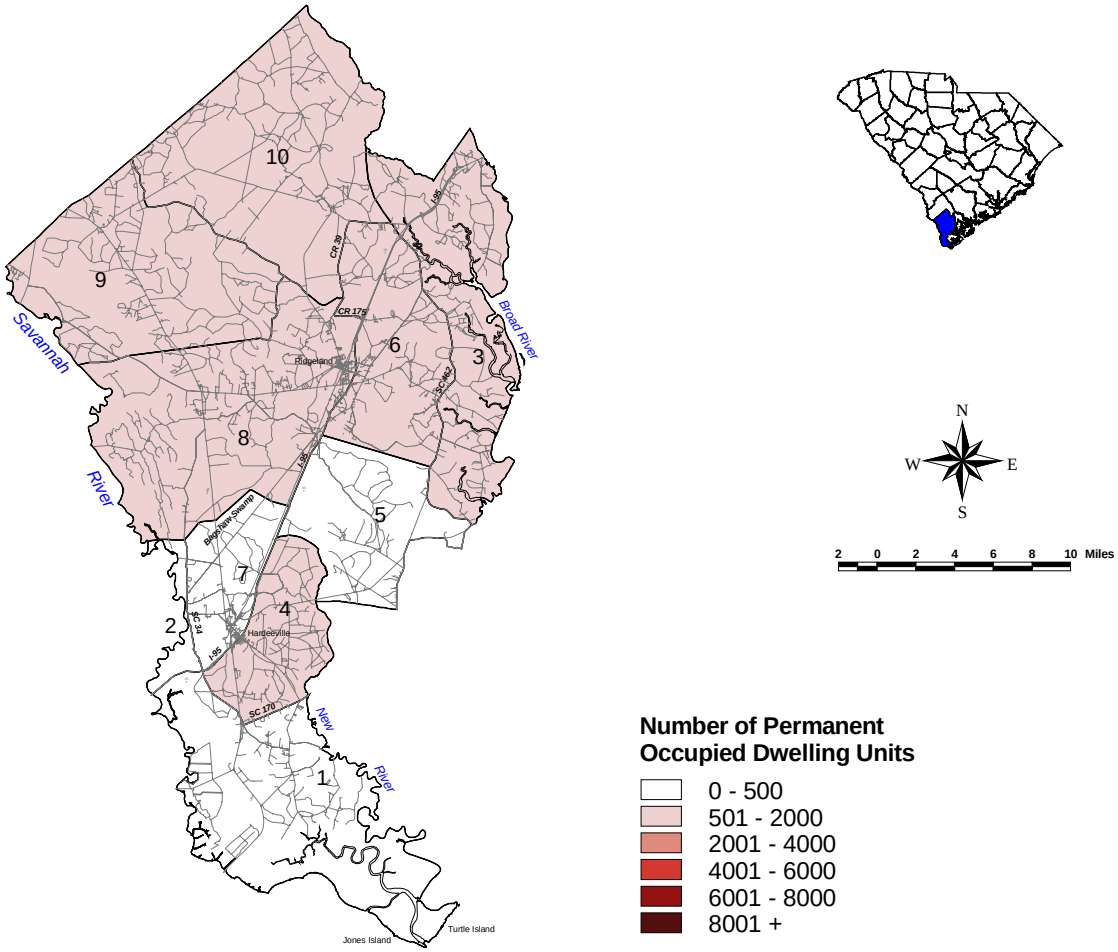


South Carolina Hurricane Evacuation Restudy

Figure 3-43. Category 3-5 Hurricane High Tourist Occupancy, Beaufort County

Permanent Occupied Dwelling Units

Jasper County

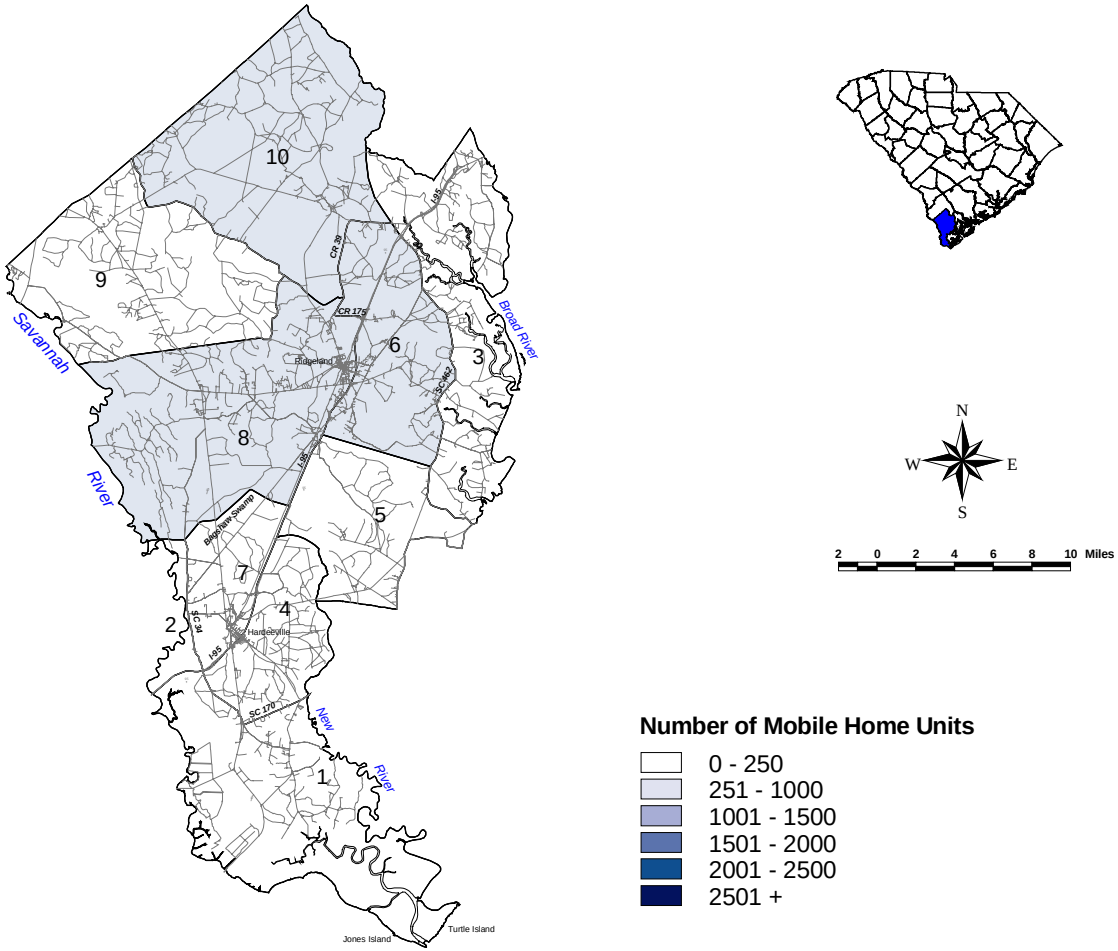


South Carolina Hurricane Evacuation Restudy

Figure 3-44. Permanent Occupied Dwelling Units, Jasper County

Mobile Home Units

Jasper County

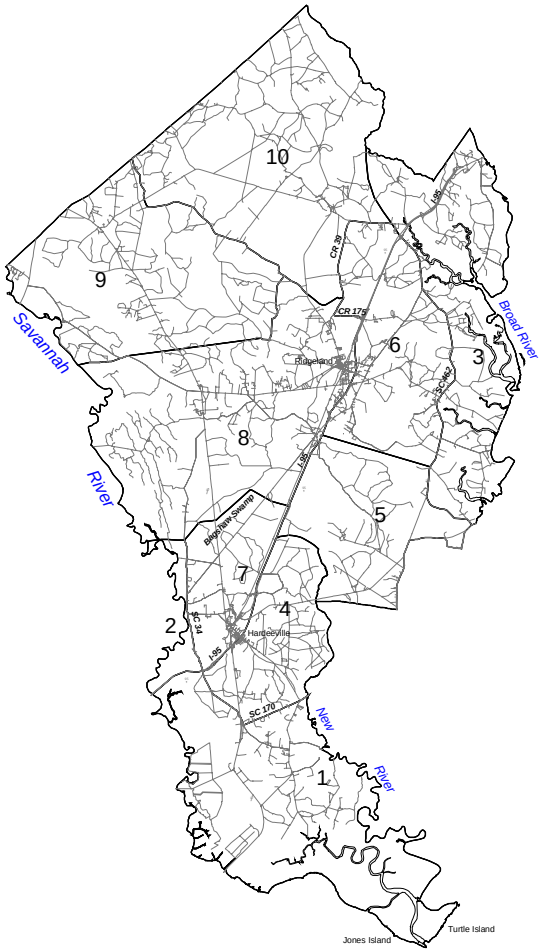


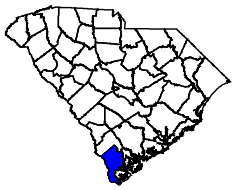
South Carolina Hurricane Evacuation Restudy

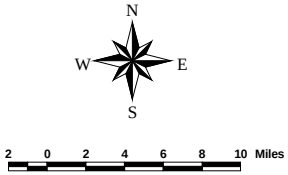
Figure 3-45. Mobile Home Units, Jasper County

Seasonal Dwelling Units

Jasper County







Number of Seasonal Dwelling Units

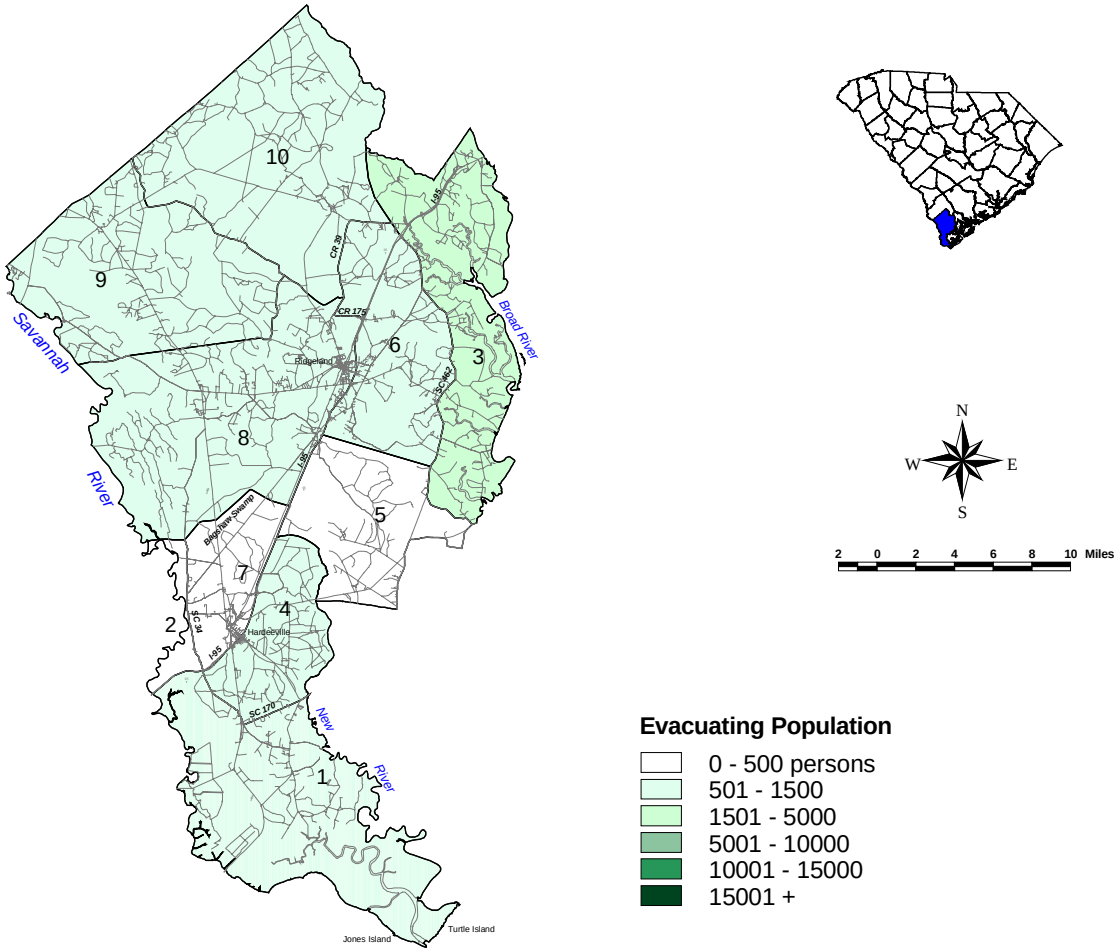
- 0 - 100
- 101 - 500
- 501 - 1500
- 1501 - 3000
- 3001 - 4500
- 4501 +

South Carolina Hurricane Evacuation Restudy

Figure 3-46. Seasonal Dwelling Units, Jasper County

Evacuating Population

Category 1-2 Hurricane
Jasper County

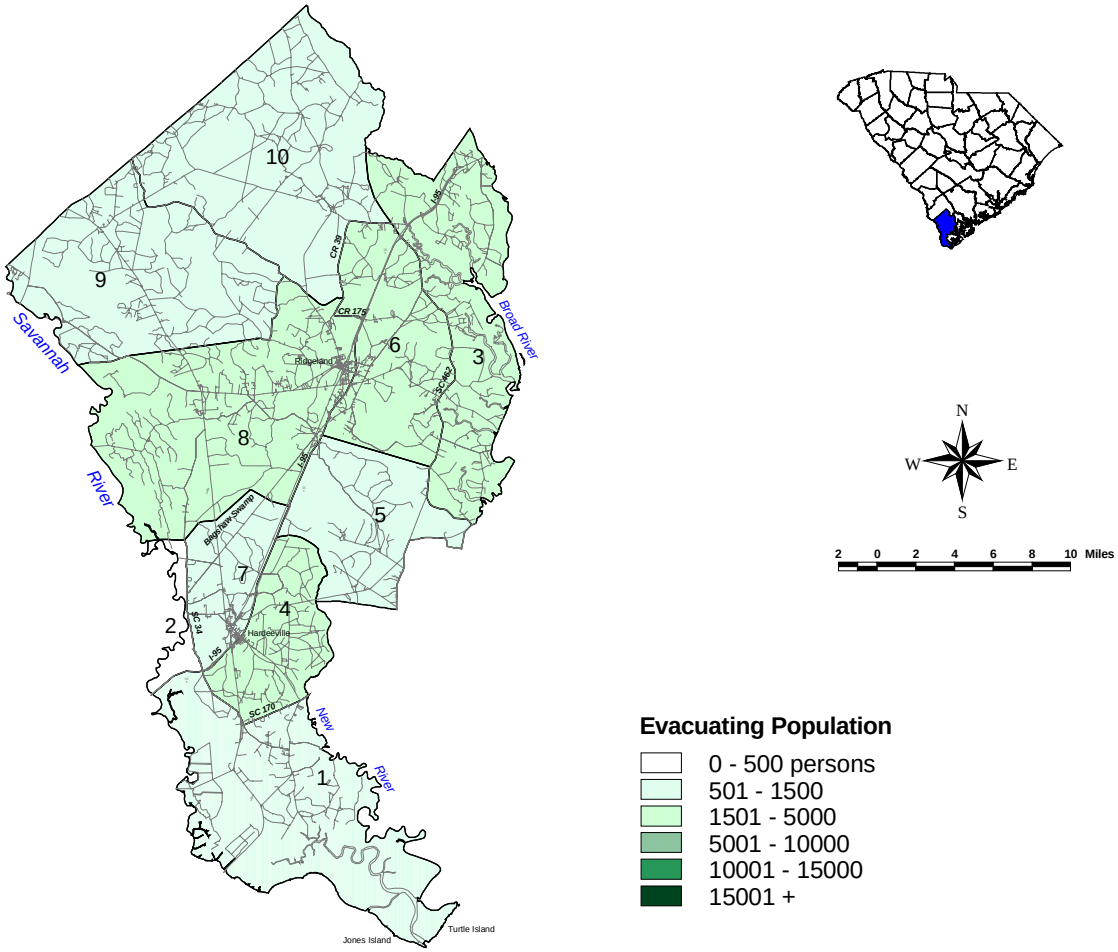


South Carolina Hurricane Evacuation Restudy

Figure 3-47. Evacuating Population Cat 1-2 Hurricane, Jasper County

Evacuating Population

Category 3-5 Hurricane
Jasper County



South Carolina Hurricane Evacuation Restudy

Figure 3-48. Evacuating Population Cat 3-5 Hurricane, Jasper County

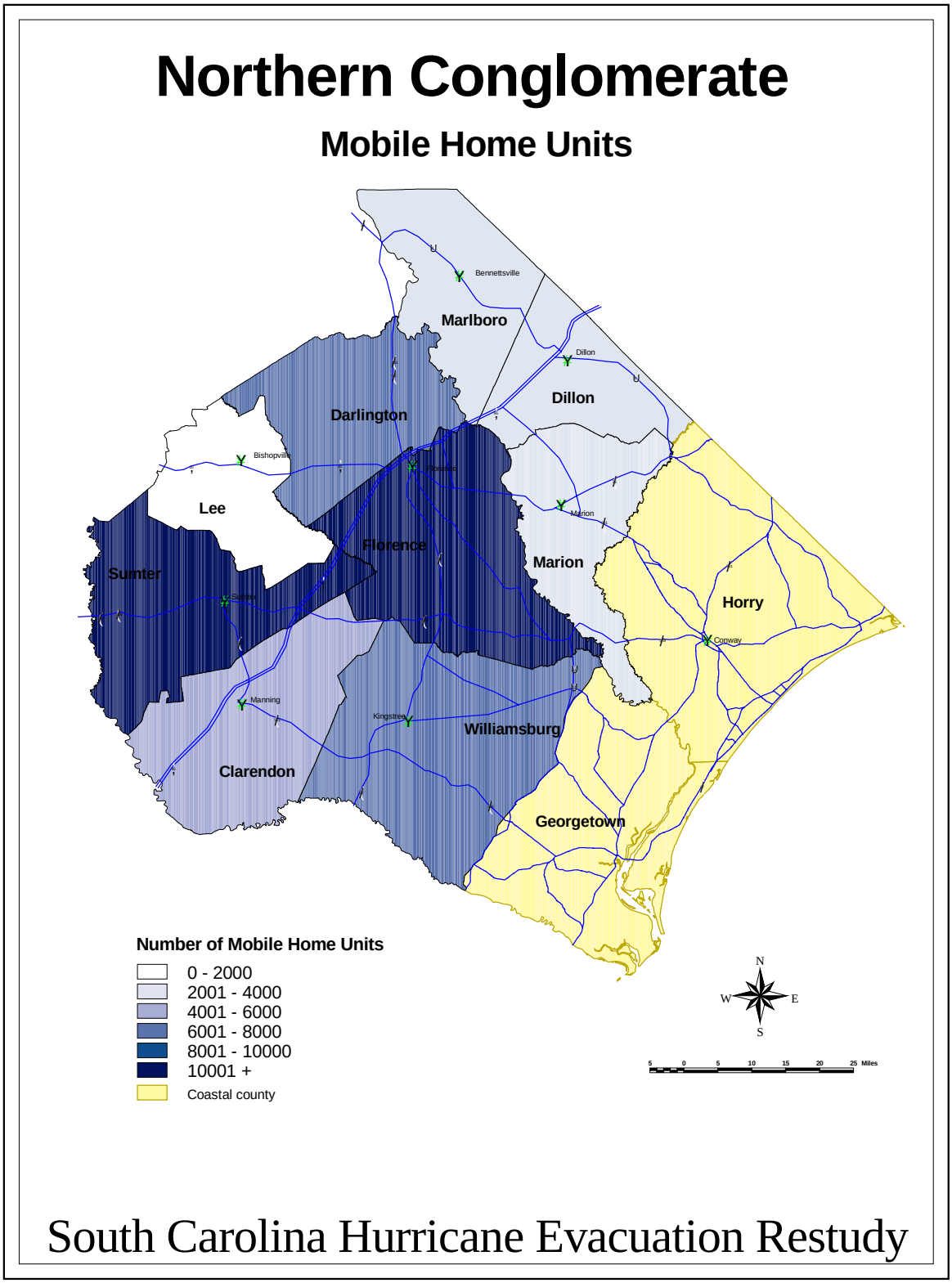


Figure 3-49. Northern Conglomerate Mobile Home Units

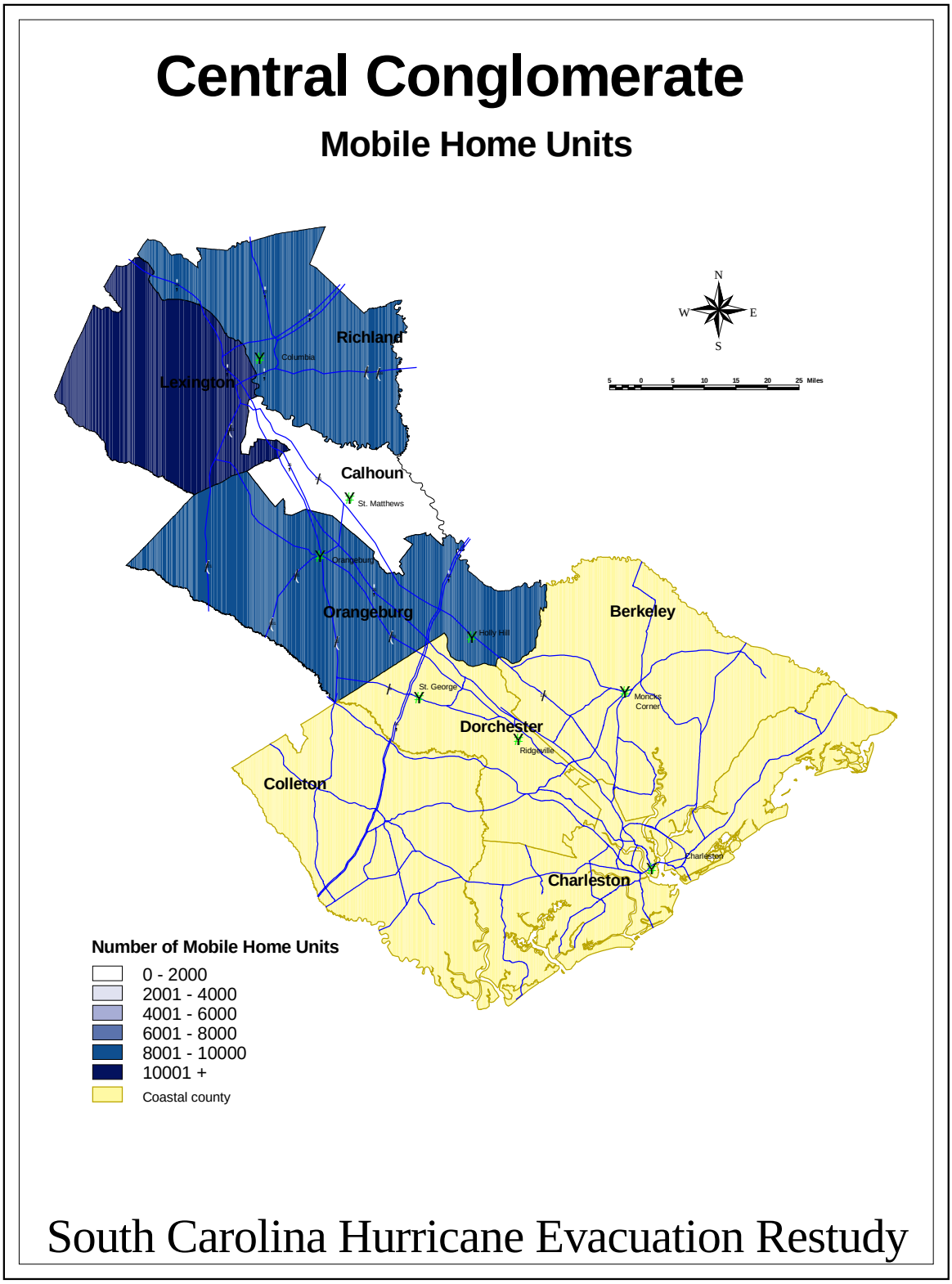


Figure 3-50. Central Conglomerate Mobile Home Units

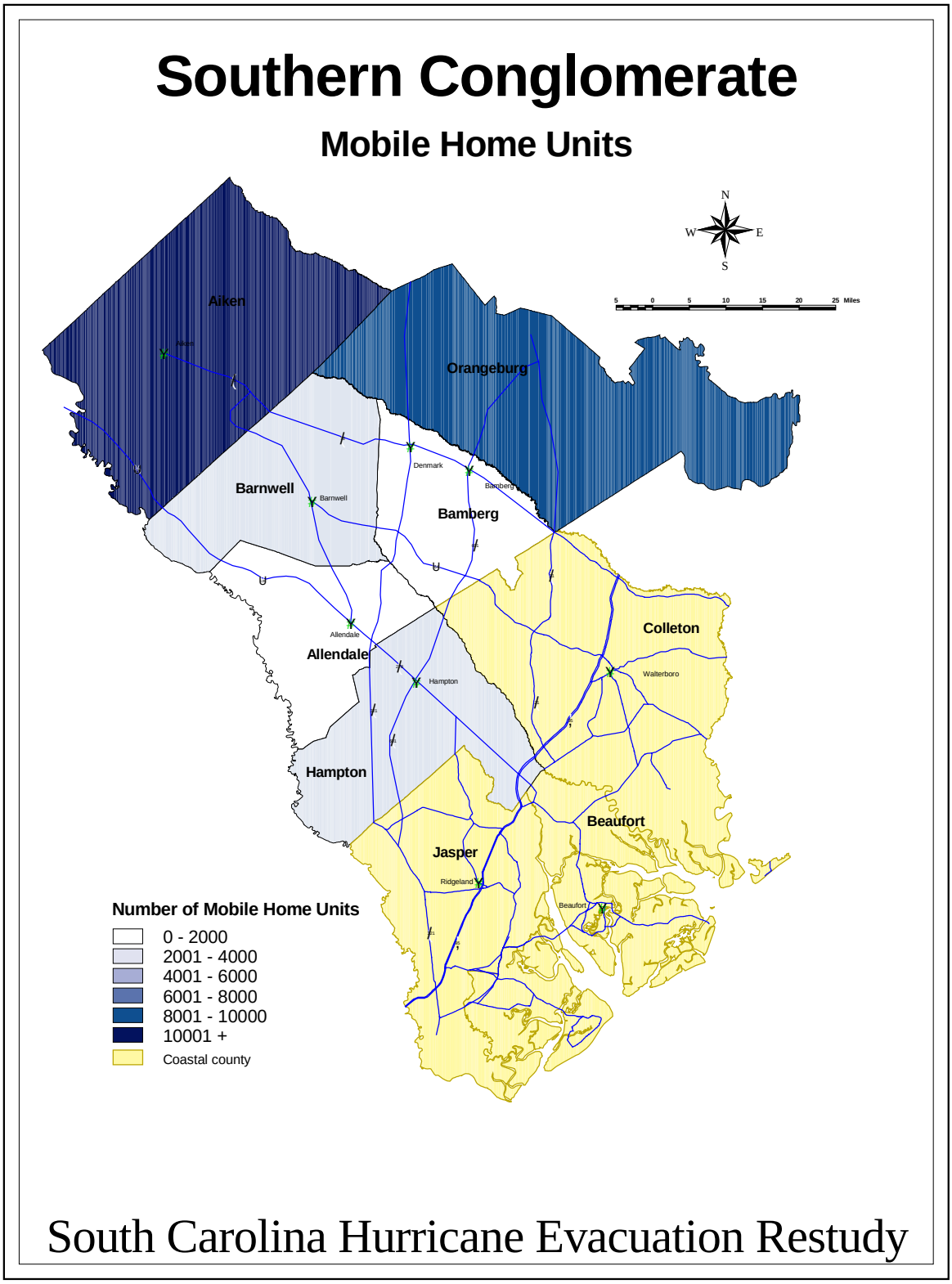


Figure 3-51. Southern Conglomerate Mobile Home Units

3.5 CRITICAL FACILITIES

Critical facilities include facilities that may need assistance or special consideration during evacuation or immediately after the storm has past. Medical facilities, Fire and Police stations are examples of critical facilities needing special consideration and planning if they are to be evacuated. Other critical facilities may include those that supply critical services and supplies after a hurricane such as food, water, power, fuel, medical services and building and repair supplies. Tables 3-4 through 3-8, at the end of this Chapter, list the critical facilities compiled by facility type. These tables show the county, facility name and/ or facility type, the city it is located in, the critical function it performs and what hurricane category storm surge it is in. If the facility shows a "0" for the Hurricane Category column, it is not located in a hurricane surge area.

Critical facilities' building administrators should be aware of the potential for wind damage to multi-story buildings. Post-hurricane surveys in other areas show that extreme winds can inflict major damage to substantial structures, exposing occupants to life-threatening danger. Hurricane preparedness plans based on moving people from potential surge levels vertically to upper floors must take into account the location and size of windows and doors, as well as the structural integrity of the building itself. Agencies responsible for hurricane preparedness of special needs facilities (hospitals, nursing homes, adult homes, and correctional facilities) should ensure that proper attention is given to the complex task of planning and coordinating emergency response.

In tables 3-4 through 3-8, normal (Normal Storm Surge) and Fast (Fast Storm Surge) moving storm inundation maps were used to determine the location of critical facilities relative to storm surge. Facilities located in FEMA Special Flood Hazard Areas (SFHA) are also indicated. Normal storm surge and fast storm surge values indicate the weakest category storm in which the critical facility is located. The last column "FEMA SFHA" indicates whether a facility is in the FEMA Special Flood Hazard Area (SFHA). The SFHA is the 100-year flood zone including the A, AE, and VE zones from FEMA Q3 flood data. "YES" indicates that the facility is in a FEMA SFHA and "*" indicates the facility is not in the FEMA SFHA.

3.5.1 Critical Facilities Data Information

The critical facilities data that appear in this document were taken from the South Carolina Department of Commerce CD-ROM (2/00) containing preliminary databases for Fire Departments, Public Schools, Health Care Facilities, Administrative Offices, and Civic Organizations. All critical facilities data was horizontally located using GPS with the exception of 45 Law Enforcement Facilities that were address matched using desktop mapping and geocoding software. The locations of these 45 facilities are only as accurate as the address matching will allow. No formal QA was performed on any of the locations of the critical facilities. This can cause errors in position accuracy. When mapping the

locations on storm surge inundation maps to determine the impact of storm surge upon facilities, care must be taken to evaluate the accuracy of the mapped position of the facility. The critical facilities data used in this report are approximate at best and should not be used for anything more than a planning tool without a formal QA of the location using survey-grade precision. Storm category numbers (0-5) are indicated for both Normal and Fast moving storm scenarios. The values listed in the table refer to the weakest category storm in which the critical facility is located. For example, if a listed facility is located in a Normal storm surge category 2, the facility will also be in a storm category 3, 4, and 5. A category designation of "0" indicates the facility is not located in a surge zone.

3.6 EVACUATION ROUTE FLOODING

Evacuation route flooding can be caused by rainfall runoff and storm tide. Hurricane evacuations are normally timed so that evacuees can reach safe shelter prior to the arrival of sustained tropical storm winds. Because of the wide variation in amounts and times of occurrence from one storm to another, rainfall can only be addressed in general terms. For most hurricanes, the heaviest rainfall begins near the time of arrival of sustained tropical storm winds. In some cases, however, over 20 inches of rain has preceded an approaching hurricane by as much as 24 hours. The County emergency management office should increase clearance times if it appears that the capacity of any evacuation routes would be reduced as a result of flooding prior to or during the evacuation.

3.7 EMERGENCY TRANSPORTATION NEEDS

Evacuation preparedness plans should consider all persons who do not have access to a private vehicle and therefore would have to rely on public transportation for evacuation. Local government should attempt to arrange for adequate resources to meet the demand for public transportation. Planning for adequate special needs emergency transportation for residents in private homes is usually the responsibility of local emergency management officials, while transportation for those in health-related facilities should be the responsibility of the individual facilities. Although detailed information concerning residents of private homes may be difficult to obtain, each local government should develop procedures for maintaining an up-to-date roster of persons likely to need special assistance. Non-ambulatory patients will require transportation that can easily accommodate wheelchairs, stretchers, and, possibly, life-sustaining equipment. Lack of resources for these needs could result in critical evacuation delays and increased hazards for the evacuees.

TABLE 3-4. Coastal EMS Facilities ("*" Indicates Not Located In FEMA Special Flood Hazard Area)

COUNTY	FACILITY NAME	CITY	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SFHA
Beaufort	Beaufort Co EMS System	Beaufort	4	3	*
Beaufort	Hilton Head Island EMS	Hilton Head Isl.	2	1	YES
Berkeley	Alcoa-Mount Holly	Goose Creek	0	0	*
Berkeley	Goose Creek EMS	Goose Creek	0	0	*
Berkeley	Hanahan Fire/EMS	Hanahan	0	0	*
Berkeley	Berkeley County EMS	Moncks Corner	0	0	YES
Charleston	Charleston Cnty EMS Medic #8	Adams Run	0	0	*
Charleston	Meducare-Ground Ambu. Service	Charleston	1	1	YES
Charleston	Meducare-MUSC Air Ambulance	Charleston	2	2	YES
Charleston	Personal Care Ambulance	Charleston	3	2	*
Charleston	Charleston Cnty EMS Medic #1	Charleston	1	1	YES
Charleston	Charleston EMS Administration	Charleston	2	2	YES
Charleston	Charleston Cnty EMS Medic #3	Charleston	3	3	*
Charleston	Charleston Cnty EMS Medic #4	James Island	3	2	YES
Charleston	Charleston Cnty EMS Medic #10	Johns Island	4	3	YES
Charleston	Charleston Cnty EMS Medic #7	Johns Island	5	4	*
Charleston	Rural Metro-Charleston	Ladson	0	0	*
Charleston	Charleston Cnty EMS Medic #6	McClellanville	3	2	YES
Charleston	Charleston Cnty EMS Medic	Mt. Pleasant	4	3	*
Charleston	Charleston Cnty EMS Medic #5	Mt. Pleasant	5	4	*
Charleston	Charleston County EMS	North Charleston	3	3	YES
Charleston	Roper Lifelink	North Charleston	0	0	*
Charleston	Charleston Cnty EMS Medic #12	North Charleston	0	0	*
Charleston	Charleston Cnty EMS Medic #2	North Charleston	0	0	*
Charleston	Charleston Cnty EMS Medic #9	North Charleston	0	0	*
Charleston	Charleston EMS 911 Dispatch	North Charleston	1	1	YES
Charleston	Charleston Cnty EMS Medic #14	Ravenel	0	0	*
Charleston	Charleston Cnty EMS Medic 8	Younges Island	0	0	*
Colleton	Colleton County EMS	Walterboro	0	0	*
Dorchester	Dorchester County EMS	Summerville	0	0	*
Georgetown	Georgetown Co EMS	Georgetown	4	3	*
Georgetown	Pawleys Island-Litchfield R.S.	Pawleys Island	5	5	*
Hampton	Hampton County EMS	Hampton	0	0	*
Horry	Aynor Vol Rescue Squad	Aynor	0	0	*
Horry	Horry County EMS	Conway	0	0	*
Horry	Horry County Rescue Squad	Conway	0	0	*
Horry	North Horry Rescue Squad	Loris	0	0	*
Horry	Myrtle Beach Fire Department	Myrtle Beach	0	0	*
Horry	Myrtle Beach Rescue Squad	Myrtle Beach	0	5	*
Horry	North Myrtle Beach Rescue	N. Myrtle Beach	0	0	*
Horry	Surfside Beach Rescue Squad	Surfside Beach	3	2	YES
Marion	Mt Olive Rescue Squad	Nichols	0	0	*

TABLE 3-5. Coastal EOC Facilities ("*" Indicates Not Located In FEMA Special Flood Hazard Area)

COUNTY	FACILITY NAME	CITY	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SFHA
Beaufort	Beaufort County Emergency Preparedness	Beaufort	5	4	*
Berkeley	Berkeley County Emergency Preparedness	Moncks Corner	0	0	*
Charleston	Charleston County Emergency Preparedness	N. Charleston	0	0	*
Colleton	Colleton County Emergency Preparedness	Walterboro	0	0	*
Dorchester	Dorchester County Emergency Preparedness	Summerville	0	0	*
Georgetown	Georgetown County Emergency Preparedness	Georgetown	4	3	*
Hampton	Hampton County Emergency Preparedness	Hampton	0	0	*
Horry	Horry County Emergency Preparedness	Conway	0	0	*
Jasper	Jasper County Emergency Preparedness	Ridgeland	0	0	*

TABLE 3-6. Coastal Fire Departments ("*" Indicates Not Located In FEMA Special Flood Hazard Area)

COUNTY	FACILITY NAME	STATION NUMBER	CITY	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SFHA
Beaufort	Hilton Head	#6	Hilton Head	2	1	*
Beaufort	Hilton Head	#5	Hilton Head	5	4	*
Beaufort	Lady's Island-St. Helena	Headquarters	Beaufort	1	1	YES
Beaufort	Burton	#894	Beaufort	0	0	*
Beaufort	Sheldon	Kean Neck	Sheldon	3	3	*
Beaufort	Burton	Burton Hill	Beaufort	0	5	*
Beaufort	Beaufort	Headquarters	Beaufort	5	4	*
Beaufort	Beaufort	#2	Beaufort	2	2	YES
Beaufort	Lady's Island-St. Helena	Station #21	Beaufort	0	5	*
Beaufort	Lady's Island-St. Helena	#23	Beaufort	5	3	*
Beaufort	Lady's Island-St. Helena	#22	Beaufort	2	2	YES
Beaufort	Fripp Island	Fripp Island	Fripp Island	2	1	YES
Beaufort	Lady's Island-St. Helena		Beaufort	2	2	YES
Beaufort	Burton	#893	Beaufort	5	4	*
Beaufort	Bluffton Township Fire District	Pritchardville Station #31	Bluffton	0	0	*
Beaufort	Bluffton Township Fire District	Headquarters Bluffton Station #30	Bluffton	4	3	*
Beaufort	Bluffton Township Fire District	Chechessee Station #32	Bluffton	4	3	*
Beaufort	Bluffton Township Fire District	Buckingham Station #33	Bluffton	2	2	YES
Beaufort	Hilton Head	#4	Hilton Head	2	2	YES
Beaufort	Hilton Head	#3	Hilton Head	2	2	YES
Beaufort	Hilton Head	#2	Hilton Head	2	1	YES
Beaufort	Hilton Head	Headqtrs Admin office	Hilton Head	2	1	YES
Beaufort	Burton	#892	Beaufort	0	0	*
Beaufort	Sheldon Fire Dept.	Station #40	Sheldon	5	4	*
Beaufort	Daufuskie Island Fire Dept	Daufuskie Island Fire Dept	Daufuskie Island	1	1	YES
Berkeley	41 Rural Volunteer Fire Dept.	Forty One	St. Stephen	0	0	*
Berkeley	Alvin Rural Volunteer Fire Dept.	Alvin	St. Stephen	0	0	*
Berkeley	C & B Rural Volunteer Fire Dept.	C & B	Ladson	0	0	*
Berkeley	Cainhoy Rural Volunteer Fire Dept.	Cainhoy Station #3	Wando	0	0	*
Berkeley	Cainhoy Rural Volunteer Fire Dept.	Cainhoy Station #4	Wando	0	0	*
Berkeley	Cainhoy Rural Volunteer Fire Dept.	Cainhoy Station #	Huger	0	0	*
Berkeley	Caromi Rural Fire Dept.	Caromi	Ladson	0	0	*
Berkeley	Cordesville Rural Volunteer Fire Dept.	Cordesville	Moncks Corner	0	0	*

TABLE 3-6. Coastal Fire Departments ("*" Indicates Not Located In FEMA Special Flood Hazard Area)

COUNTY	FACILITY NAME	STATION NUMBER	CITY	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SFHA
Berkeley	Cross Rural Volunteer Fire Dept.	Cross station 1	Cross	0	0	*
Berkeley	Cross Rural Volunteer Fire Dept.	Station 1	Cross	0	0	*
Berkeley	Eadytown Rural Volunteer Fire Dept.	Eadytown	Pineville	0	0	*
Berkeley	Goose Creek City Fire Dept.	Goose Creek	Goose Creek	0	0	*
Berkeley	Goose Creek Rural Volunteer Fire Dept.	Goose Creek Station 1	Goose Creek	0	0	*
Berkeley	Huger Rural Volunteer Fire Dept.	Huger	Huger	0	0	*
Berkeley	Jamestown Rural Volunteer Fire Dept.	Jamestown	Jamestown	0	0	*
Berkeley	Lake Moultrie Rural Volunteer Fire Dept.	Lake Moultrie	Bonneau	0	0	*
Berkeley	Longridge Rural Volunteer Fire Dept.	Longridge	Moncks Corner	0	0	*
Berkeley	Macedonia Rural Volunteer Fire Dept.	Macedonia Station 1	Bonneau	0	0	*
Berkeley	Macedonia Rural Volunteer Fire Dept.	Macedonia Station 2	Cordesville	0	0	*
Berkeley	Moncks Corner Rural Volunteer Fire Dept.	Moncks Corner Station 1	Moncks Corner	0	0	*
Berkeley	Moncks Corner Rural Volunteer Fire Dept.	Moncks Corner Station 2	Moncks Corner	0	0	*
Berkeley	Pimlico Rural Volunteer Fire Dept.	Pimlico	Moncks Corner	0	0	YES
Berkeley	Pine Ridge Rural Volunteer Fire Dept.	Devon Forest Station 3	Summerville	0	0	*
Berkeley	Pine Ridge Rural Volunteer Fire Dept.	New Hope Station 2	Summerville	0	0	*
Berkeley	Pine Ridge Rural Volunteer Fire Dept.	Pine Ridge Station 1	Summerville	0	0	*
Berkeley	Pineville/Russellville Rural Volunteer Fire Dept.	Pineville/Russellville RVFD	Pineville	0	0	*
Berkeley	Pringletown Rural Volunteer Fire Dept.	Pringletown	Ridgeville	0	0	*
Berkeley	Sandridge Rural Volunteer Fire Dept.	Sandridge	Ridgeville	0	0	*
Berkeley	Santee Circle Rural Volunteer Fire Dept.	Santee Circle	Moncks Corner	0	0	*
Berkeley	Shulerville-HoneyHill Rural Volunteer Fire Dept.	Shulerville-Honey Hill	Jamestown	0	0	*
Berkeley	St. Stephen Rural Volunteer Fire Dept.	St. Stephen	St. Stephen	0	0	*
Berkeley	U.S. Forest Servicee	USFS Witherbee Ofc.	Cordesville	0	0	*
Berkeley	Whitesville Rural Volunteer Fire Dept.	Whitesville Station 1	Moncks Corner	0	0	*
Berkeley	Whitesville Rural Volunteer Fire Dept.	Whitesville Station 2	Moncks Corner	0	0	*
Berkeley	Hanahan Fire Dept.	Hanahan Fire Dept.	Hanahan	0	0	*
Charleston	St. Paul's Fire Dept.	Hollywood/Headquarters/#1	Hollywood	0	0	*
Charleston	St. Paul's Fire Dept.	Adam's Run/#5	Adam's Run	0	0	*
Charleston	St. John's Fire Dept.	#2	Seabrook Island	1	1	YES
Charleston	Awendaw Fire district	Awendaw/Headquarters/#2	Awendaw	5	4	*
Charleston	Awendaw Fire District	Awendaw Station 3	Awendaw	0	5	*
Charleston	St. Paul's Fire Dept.	Ravenal/#4	Ravenal	0	0	*

TABLE 3-6. Coastal Fire Departments ("*" Indicates Not Located In FEMA Special Flood Hazard Area)

COUNTY	FACILITY NAME	STATION NUMBER	CITY	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SFHA
Charleston	St. Paul's Fire Dept.	Sauldam Station/#2	Ravenal	0	0	*
Charleston	St. John's Fire Dept.	#4	Kiawah Island	1	1	YES
Charleston	St. John's Fire Dept.	Wadmalaw Island/#3	Wadmalaw island	5	3	*
Charleston	St. John's Fire Dept.	#5	John's Island	3	2	*
Charleston	City of Charleston	Johns Isle #17	John's Island	4	3	*
Charleston	St. John's Fire Dept.	#1	John's Island	0	0	*
Charleston	City of Charleston Fire Dept.	#8	Charleston	2	2	YES
Charleston	James Island Fire Dept.	#3	James Island	0	0	*
Charleston	James Island Fire Dept.	#4	James Island	2	2	YES
Charleston	James Island Fire Dept.	Head Quarters/#1	James Island	3	3	*
Charleston	James Island Fire Dept.	#2	James Island	2	2	YES
Charleston	Town of Mt. Pleasant	#5	Mt. Pleasant	3	2	*
Charleston	Awendew Fire Dept.	#4	McClellanville	2	1	YES
Charleston	Awendaw Fire Dept.	Wambaugh Ofc.	McClellanville	2	2	YES
Charleston	City of Charleston Fire Dept.	#13	Charleston	3	3	*
Charleston	Folly Beach Public Servicee		Folly Beach	2	1	YES
Charleston	City of Charleston Fire Dept.	#7	Charleston	2	2	*
Charleston	City of Charleston Fire Dept.	#2	Charleston	2	2	YES
Charleston	City of Charleston Fire Dept.	#3	Charleston	2	2	YES
Charleston	Sullivan's Island Fire Dept.	S. I. Emergency Command Center	Sullivan's Island	1	1	YES
Charleston	Town of Mt. Pleasant	#1	Mt. Pleasant	5	4	*
Charleston	Town of Mt. Pleasant	Headquarters	Mt. Pleasant	4	4	*
Charleston	Town of Mt. Pleasant	#3	Mt. Pleasant	5	4	*
Charleston	Town of Mt. Pleasant	#2	Mt. Pleasant	0	5	*
Charleston	St. Andrew's Fire Dept.	#4	Charleston	2	2	*
Charleston	St. Andrew's Fire Dept.	Headquarters/#1	Charleston	3	2	*
Charleston	St. Andrew's Fire Dept.	#2	Charleston	3	2	*
Charleston	Lincolnville Fire Dept.		Lincolnville	0	0	*
Charleston	City of Charleston Fire Dept.	#12	Charleston	2	2	*
Charleston	City of Charleston Fire Dept.	#6	Charleston	1	1	YES
Charleston	City of Charleston Fire Dept.	#10	Charleston	2	2	YES
Charleston	City of Charleston Fire Dept.	Headquarters/#1	Charleston	2	2	YES
Charleston	Town of Mt. Pleasant	#4	Mt. Pleasant	5	3	*

TABLE 3-6. Coastal Fire Departments ("*" Indicates Not Located In FEMA Special Flood Hazard Area)

COUNTY	FACILITY NAME	STATION NUMBER	CITY	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SFHA
Charleston	Isle of Palms Fire Dept.	Headquarters/#1	Isle of Palms	2	2	YES
Charleston	Isle of Palms Fire Dept.	#2	Isle of Palms	1	1	YES
Charleston	City of North Charleston	#8	North Charleston	3	3	*
Charleston	City of North Charleston	#1	North Charleston	0	0	*
Charleston	City of North Charleston	Headquarters	North Charleston	0	0	*
Charleston	City of North Charleston	#9	North Charleston	0	0	*
Charleston	City of North Charleston	#7	North Charleston	3	2	YES
Charleston	City of North Charleston	#10	North Charleston	0	0	*
Charleston	City of North Charleston	#3	North Charleston	0	0	*
Charleston	City of North Charleston	#2	North Charleston	3	3	YES
Charleston	City of North Charleston	#4	North Charleston	0	0	*
Charleston	City of North Charleston	#6	North Charleston	0	0	*
Charleston	St. Paul's Fire Dept.	Edisto Island/#3	Edisto Island	2	1	YES
Charleston	City of North Charleston	#5	North Charleston	4	3	*
Colleton	Neyles Fire Dept.	Neyles	Walterboro	0	0	*
Colleton	Canadys Volunteer Fire Dept.	Canadys VFD	Canadys	0	0	*
Colleton	Canadys Volunteer Fire Dept.	Canadys VFD Substation	Canadys	0	0	*
Colleton	Intercommunity Volunteer Fire Dept.	Intercommunitty VFD	Yemassee	0	0	*
Colleton	Hendersonville Volunteer Fire Dept.	Hendersonville VFD	Walterboro	0	0	*
Colleton	Green Pond Volunteer Fire Dept.	Green pond VFD	Green Pond	0	0	*
Colleton	Jacksonboro Volunteer Fire Dept.	Jacksonboro VFD	Jacksonboro	4	4	*
Colleton	Ruffin Volunteer Fire Dept.	Ruffin VFD	Ruffin	0	0	*
Colleton	Smoaks Fire Dept.	Smoaks VFD	Smoaks	0	0	*
Colleton	Lodge Volunteer Fire Dept.	Lodge VFD	Lodge	0	0	*
Colleton	Colleton Rural Volunteer Fire Dept.	Colleton Rural VFD	Walterboro	0	0	*
Colleton	Islandton Volunteer Fire Dept.	Islandton VFD	Islandton	0	0	*
Colleton	Maple Cane Volunteer Fire Dept.	Maple Cane VFD	Cottageville	0	0	*
Colleton	Cottageville Fire Dept	Cottageville Fire Dept	Cottageville	0	0	*
Colleton	Edisto Beach Fire Dept	Edisto Beach Fire Dept	Edisto Beach	2	1	YES
Colleton	Walterboro Fire Dept	Walterboro Fire Dept	Walterboro	0	0	*
Dorchester	Cattle Creek	Cattle Creek Fire Dept.	Reevesville	0	0	*
Dorchester	Dorchester Volunteer Fire Dept.	Dorchester Rural	Dorchester	0	0	*
Dorchester	Givhans Fire & Rescue	Givhans Fire Dept.	Ridgeville	0	0	*

TABLE 3-6. Coastal Fire Departments ("*" Indicates Not Located In FEMA Special Flood Hazard Area)

COUNTY	FACILITY NAME	STATION NUMBER	CITY	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SFHA
Dorchester	Grover	Grover Fire Dept.	St. George	0	0	*
Dorchester	Harleyville Rural Fire Dept.	Harleyville Rural Fire Department	Harleyville	0	0	*
Dorchester	Indian Field Volunteer Fire Dept.	Indian Field Volunteer Fire Dept.	Harleyville	0	0	*
Dorchester	Old Forte Fire Dept.	Station #4	Summerville	0	0	*
Dorchester	Old Forte Fire Dept.	Station #1	Ladson	0	0	YES
Dorchester	Old Forte Fire Dept.	Station #3	Summerville	0	0	*
Dorchester	Old Forte Fire Dept.	Station #2	Summerville	0	0	*
Dorchester	Old Forte Fire Dept.	Station #5	Summerville	0	0	*
Dorchester	Reevesville	Reevesville Fire Department	Reevesville	0	0	*
Dorchester	Ridgeville Fire & Rescue	Ridgeville VFD Station #2	Ridgeville	0	0	*
Dorchester	Ridgeville Volunteer Fire Dept.	Ridgeville RVFD Station #1	Ridgeville	0	0	*
Dorchester	SandHill Volunteer Fire Dept.	SandHill Volunteer Fire Dept.	Ridgeville	0	0	YES
Dorchester	St. George Fire Dept.		St. George	0	0	*
Dorchester	Ashley River Fire Dept.		North Charleston	0	0	*
Dorchester	Summerville Fire Dept.	Station #1	Summerville	0	0	*
Georgetown	Midway Fire Dept.	Debordieu	Pawley's Island	1	1	*
Georgetown	Midway Fire Dept.	Willowbrook Plantation	Pawley's Island	4	4	*
Georgetown	Georgetown co. Rural Fire Dept.	#8	Georgetown	0	0	*
Georgetown	Georgetown Co. Rural Fire Dept.	#3	Georgetown	0	0	*
Georgetown	Andrews City Fire Dept.		Andrews	0	0	*
Georgetown	Georgetown co. Rural Fire Dept.	#12	Georgetown	0	0	*
Georgetown	Georgetown co. Rural Fire Dept.	#14	Hemingway	0	0	*
Georgetown	Georgetown Co. Rural Fire Dept.	#4	Hemingway	0	0	*
Georgetown	Georgetown City Fire Dept.	#1 and #2	Georgetown	4	4	YES
Georgetown	Georgetown Co. Rural Fire Dept.	#11	Georgetown	5	5	*
Georgetown	Georgetown Co. Rural Fire Dept.		Georgetown	4	4	YES
Georgetown	Georgetown Co. Rural Fire Dept.	High Market Street	Georgetown	0	5	*
Georgetown	Georgetown Co. Rural Fire Dept.		Georgetown	0	0	*
Georgetown	Georgetown Co. Rural Fire Dept.		Georgetown	5	5	*
Georgetown	Murrell's Inlet Fire Dept.	Murrells Inlet - Garden City Fire	Murrell's Inlet	3	3	*
Georgetown	Mack Reed Fire Dept	Mack Reed Fire Dept	Georgetown	4	3	*
Georgetown	Garden City Fire District	Garden City Fire District	Murrells Inlet	0	5	*
Georgetown	Georgetown County Fire Dept	Georgetown County Fire Dept	Georgetown	4	3	*

TABLE 3-6. Coastal Fire Departments ("*" Indicates Not Located In FEMA Special Flood Hazard Area)

COUNTY	FACILITY NAME	STATION NUMBER	CITY	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SFHA
Georgetown	Midway Fire Dept	Midway Fire Dept	Pawley's Island	5	4	*
Hampton	Cummings Fire Dept.	Cummings FD	3278701	0	0	*
Hampton	Yemassee Fire Dept.	Yemassee FD	Yemassee	0	0	*
Hampton	Gifford Fire Dept.	Gifford FD	Gifford	0	0	*
Hampton	Nixville Fire Dept.	Nixville FD	Estill	0	0	*
Hampton	Furman Fire Dept.	Furman FD	Furman	0	0	*
Hampton	Estill Fire Dept.	Estill FD	Estill	0	0	*
Hampton	Brunson Fire Dept.	Brunson FD	Brunson	0	0	*
Hampton	Hampton Fire Dept.	Hampton FD	Hampton	0	0	*
Hampton	Shirley Fire Dept.	Shirley FD	Garnett	0	0	*
Hampton	Varnville Fire Dept.	Varnville fd	Varnville	0	0	*
Horry	Horry Co. Fire Dept.	Mt. Vernon #17	Loris	0	0	*
Horry	Horry Co. Fire Dept.	Longs #13	Longs	0	0	*
Horry	Horry Co. Fire Dept.	Baybore	Loris	0	0	*
Horry	Horry Co. Fire Dept.	Bucksport	Conway	0	0	*
Horry	Horry Co. Fire Dept.	Nixonville #12	Conway	0	0	*
Horry	Horry Co. Fire Dept.	Shell #14	Conway	0	0	*
Horry	Horry Co. Fire Dept.	Cates Bay	Conway	0	0	*
Horry	Horry Co. Fire Dept.	Juniper Bay	Conway	0	0	*
Horry	City of Conway Fire Dept.	Conway	Conway	0	0	*
Horry	Horry Co. Fire Dept.	University #23	Conway	0	0	*
Horry	Horry Co. Fire Dept.	Allen's #27	Conway	0	0	*
Horry	Horry Co. Fire Dept.	Maple Station #2	Conway	0	0	*
Horry	Horry Co. Fire Dept.	Forest Brooks #4	Myrtle Beach	0	0	*
Horry	Horry Co. Fire Dept.	Socastee #1	Myrtle Beach	0	0	*
Horry	City of Myrtle Beach Fire Dept.	#4	Myrtle Beach	0	5	*
Horry	City of Myrtle Beach Fire Dept.	Myrtle Beach Fire Dept.	Myrtle Beach	0	0	*
Horry	Horry Co. Fire Dept.	Lake Arrowhead	Myrtle Beach	0	0	*
Horry	N Myrtle Beach Fire Dept.	N. Myrtle Beach	N. Myrtle Beach	0	0	*
Horry	Horry Co. Fire Dept.	Brooksville	Little River	0	0	*
Horry	Horry Co. Fire Dept.	Little River #2	Little River	0	0	*
Horry	Horry Co. Fire Dept.	Wampee #5	Little River	0	0	*
Horry	N Myrtle Beach Fire Dept.	Windy Hill	N. Myrtle Beach	0	0	*

TABLE 3-6. Coastal Fire Departments ("*" Indicates Not Located In FEMA Special Flood Hazard Area)

COUNTY	FACILITY NAME	STATION NUMBER	CITY	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SFHA
Horry	Horry Co. Fire Dept.	Joyner	Galivant Ferry	0	0	*
Horry	Horry Co. Fire Dept.	Loris Fire Dept.	Loris	0	0	*
Horry	Horry Co. Fire Dept.	Goretown	Loris	0	0	*
Horry	Horry Co. Fire Dept.	Mt. olive	Nichols	0	0	*
Horry	Horry Co. Fire Dept.	Floyds	Nichols	0	0	*
Horry	Horry Co. Fire Dept.	Ketchup Town #10	Nichols	0	0	*
Horry	Horry Co. Fire Dept.	Cherry Hill	Loris	0	0	*
Horry	City of Surfside BeachFire Dept.	Surfside Beach Fire Dept	Surfside Beach	0	5	*
Horry	Murrell's Inlet & Garden	Murrell's Inlet/Garden City	Murrell's Inlet	3	3	*
Horry	City of Myrtle Beach Fire Dept.	Myrtle Beach Fire Dept.	Myrtle Beach	5	4	*
Horry	City of Myrtle Beach Fire Dept.	#2	Myrtle Beach	3	3	YES
Horry	Fair Bluff Fire Dept.	Fair Bluff FD	Fair Bluff	0	0	*
Horry	City of Myrtle Beach Fire Dept.	#1	Myrtle Beach	0	5	*
Horry	City of Myrtle Beach Fire Dept.	#3	Myrtle Beach	0	5	*
Horry	City of Myrtle Beach Fire Dept.	#5	Myrtle Beach	0	0	*
Horry	Horry Co. Fire Dept.	Headquarters	Conway	0	0	*
Jasper	Jasper Co. Fire Dept.	Point South FD	Yemassee	5	4	*
Jasper	Jasper Co. Fire Dept.	Ridgeland Fire & Rescue	Ridgeland	0	0	*
Jasper	Jasper Co. Fire Dept.	Tillman Fire Dept.	Tillman	0	0	*
Jasper	Jasper Co. Fire Dept.	Robertville-Pineland FD	Pineland	0	0	*
Jasper	Jasper Co. Fire Dept.	Coosawhatchie FD	Ridgeland	4	4	*
Jasper	Jasper Co. Fire Dept.	Levy Fire Dept.	Hardeeville	4	3	YES
Jasper	Jasper Co. Fire Dept.	Hardeeville Fire Dept.	Hardeeville	0	0	*
Jasper	Jasper Co. Fire Dept.	Grays Fire Dept.	Varnville	0	0	*
Jasper	Town Of Ridgeland Fire Dept	Ridgeland Fire Dept	Ridgeland	0	0	*

TABLE 3-7. Coastal Health Care Facilities ("*" Indicates Not Located In FEMA Special Flood Hazard Area)

COUNTY	FACILITY NAME	FACILITY TYPE	CITY	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SFHA
Beaufort	Lazarus & Mary Residential Care, Inc.	Residential Care	Yemassee	0	0	*
Beaufort	Charter Beaufort Counseling Center	Outpatient Chemical Dependencies	Beaufort	5	4	*
Beaufort	Bay View Nursing Center, Inc.	Nursing Care	Beaufort	5	4	*
Beaufort	Gertie's Care Home	Residential Care	St. Helena Island	2	2	YES
Beaufort	Care One Home Health Services	Home Health	Bluffton	5	4	*
Beaufort	Fraser Health Center	Nursing Care	Hilton Head	2	1	YES
Beaufort	Rogers Long Term Care Facility at TidePointe	Nursing Care	Hilton Head	2	1	YES
Beaufort	Hospice Care of the Low Country Home Health	Home Health	Hilton Head	4	3	*
Beaufort	Preston Health Center	Nursing Care	Hilton Head	4	3	*
Beaufort	Life Care Center of Hilton Head	Nursing Care	Hilton Head	5	4	*
Beaufort	Hilton Head Hospital	Hospital	Hilton Head	5	4	*
Beaufort	Hilton Head Hospital Skilled Nursing Unit	Nursing Care	Hilton Head	5	4	*
Beaufort	Island Health Care, Inc.	Home Health	Hilton Head	5	3	*
Beaufort	Vivra Renal Care of Hilton Head	Renal Dialysis	Hilton Head	5	4	*
Beaufort	Port Royal Community Residence	Mental Retardation Habilitation	Port Royal	3	3	*
Beaufort	Oakhurst Community Care Home	Residential Care	Dale	1	1	YES
Beaufort	Beaufort Memorial Hospital Subacute SCP	Nursing Care	Beaufort	0	5	*
Beaufort	Low Country Home Health Services	Home Health	Beaufort	0	5	*
Beaufort	Beaufort Memorial Hospital	Hospital	Beaufort	0	0	*
Beaufort	Low Country Dialysis Facility	Renal Dialysis	Beaufort	5	4	*
Beaufort	River Oaks Residential Care, Inc.	Residential Care	Port Royal	5	4	*
Beaufort	Quality Home Health, Inc.	Home Health	Hilton Head	5	4	*
Beaufort	Hospice Care of the Low Country	Hospice	Hilton Head	5	4	*
Beaufort	Island Hospice	Hospice	Hilton Head	2	2	YES
Beaufort	Beaufort Memorial Hospital Subacute SCP	Nursing Care	Beaufort	5	4	*
Beaufort	Beaufort County Alcohol & Drug Abuse Department	Outpatient Chemical Dependencies	Beaufort	5	4	*
Beaufort	Recovery Center Foundation, Inc.	Outpatient Chemical Dependencies	Hilton Head	2	1	YES
Beaufort	Bostick's Adult Residential Care Facility	Residential Care	Beaufort	5	4	*
Beaufort	Brooks Care Home	Residential Care	Yemassee	0	0	*
Berkeley	DeHay Community Residence	Mental Retardation Habilitation	Moncks Corner	0	0	*
Berkeley	Villa of Moncks Corner Active Day Center	Adult Day Care	Moncks Corner	0	0	*
Berkeley	Magnolia Manor-Moncks Corner	Nursing Care	Moncks Corner	0	0	*

TABLE 3-7. Coastal Health Care Facilities ("*" Indicates Not Located In FEMA Special Flood Hazard Area)

COUNTY	FACILITY NAME	FACILITY TYPE	CITY	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SFHA
Berkeley	Conifer I Community Residence	Mental Retardation Habilitation	Moncks Corner	0	0	*
Berkeley	Conifer II Community Residence	Mental Retardation Habilitation	Moncks Corner	0	0	*
Berkeley	Goose Creek Residential Care #2	Residential Care	Goose Creek	0	0	*
Berkeley	Goose Creek Residential Care #1	Residential Care	Goose Creek	0	0	*
Berkeley	Quality Care Residential Home II	Residential Care	Goose Creek	0	0	*
Berkeley	Antonio-Vause, Inc.	Residential Care	Goose Creek	0	0	*
Berkeley	Oakview Boarding Home	Residential Care	Moncks Corner	0	0	*
Berkeley	Backhome Care Facility	Residential Care	Cross	0	0	*
Berkeley	S & W Community Care Home	Residential Care	Alvin	0	0	*
Berkeley	Lake Moultrie Nursing Facility	Nursing Care	Saint Stephen	0	0	*
Berkeley	Presbyterian Home of South Carolina / Summerville	Residential Care	Summerville	0	0	*
Berkeley	Presbyterian Home of SC / Summerville	Nursing Care	Summerville	0	0	*
Berkeley	Moncks Corner Adult Day Care	Adult Day Care	Moncks Corner	0	0	*
Berkeley	Rainbow Residential Home	Residential Care	Moncks Corner	0	0	*
Berkeley	Heartland Health Care Center - Charleston	Nursing Care	Hanahan	0	0	YES
Berkeley	Home Health Services, Inc.	Home Health	North Charleston	0	0	*
Charleston	Lauren's Personal Care Home	Residential Care	Charleston	0	0	*
Charleston	Cabading Homes #2	Residential Care	North Charleston	0	0	*
Charleston	Hermina Traeye Memorial Nursing Home	Nursing Care	Johns Island	5	4	*
Charleston	Rhode's Boarding Home	Residential Care	Johns Island	3	3	YES
Charleston	Trident Home Health Services	Home Health	Charleston	3	3	*
Charleston	Bon Secours - St. Francis Xavier Hospital	Hospital	Charleston	1	1	YES
Charleston	Sampson's Residential Care #2	Residential Care	Charleston	3	3	*
Charleston	Jade Community Residential Care II	Residential Care	Charleston	3	3	*
Charleston	Sea Island Home Health	Home Health	Johns Island	5	4	*
Charleston	Frasier Adult Residential Care Home	Residential Care	Johns Island	0	5	*
Charleston	Hospice of Charleston Home Health Agency	Home Health	North Charleston	3	3	YES
Charleston	Hospice of Charleston, Inc.	Hospice	Charleston	3	3	YES
Charleston	Integrated Health Systems of Charleston at Driftwood	Nursing Care	North Charleston	3	2	*
Charleston	Aggalee-Blanche Community Residential Care Facility	Residential Care	Charleston	2	2	YES
Charleston	PHC Home Health	Home Health	Charleston	4	3	*
Charleston	McLeod Manor, Inc.	Residential Care	Charleston	2	2	YES
Charleston	Secessionville Community Residence	Mental Retardation Habilitation	Charleston	3	3	YES
Charleston	Farmington Community Residence	Mental Retardation Habilitation	Charleston	4	3	*

TABLE 3-7. Coastal Health Care Facilities ("*" Indicates Not Located In FEMA Special Flood Hazard Area)

COUNTY	FACILITY NAME	FACILITY TYPE	CITY	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SFHA
Charleston	Camp Road Community Residence	Mental Retardation Habilitation	Charleston	4	3	*
Charleston	Maria's Priority Care Residential Home	Residential Care	Charleston	5	5	*
Charleston	Maria's Priority Care Residential Home III	Residential Care	North Charleston	5	5	*
Charleston	Bran De Ana's Residential Care II	Residential Care	Charleston	5	4	*
Charleston	Columbia Homecare Doctor's	Home Health	North Charleston	4	3	YES
Charleston	Christine's Love	Residential Care	North Charleston	0	0	*
Charleston	Guardian Angels Residential Care	Residential Care	North Charleston	0	0	*
Charleston	Cabading Homes #3	Residential Care	N Charleston	0	0	*
Charleston	Christian Boarding Home	Residential Care	North Charleston	0	0	*
Charleston	Guardian Angels Residential Care #2	Residential Care	Charleston	5	4	*
Charleston	Evergreen Residential Care, Inc., Annex II	Residential Care	Charleston	2	2	YES
Charleston	Evergreen Residential Care, Inc., Annex I	Residential Care	Charleston	2	2	YES
Charleston	Edward and Edward Residential Care Facility	Residential Care	North Charleston	2	2	YES
Charleston	Ekklesia Residential Home Care Facility	Residential Care	Charleston	2	2	YES
Charleston	Evergreen Residential Care, Inc. II	Residential Care	Charleston	2	2	YES
Charleston	Turning Point Recovery Center	Outpatient Chemical Dependencies	Charleston	0	5	*
Charleston	Manor Care Health Services - Charleston	Nursing Care	Charleston	4	4	*
Charleston	Northbridge Adult Day Care Center	Adult Day Care	Charleston	5	4	*
Charleston	DOAODA Services of Charleston County	Outpatient Chemical Dependencies	Charleston	1	1	YES
Charleston	Citadel Infirmary	Hospital	Charleston	2	2	*
Charleston	Marjorie's Community Care Home	Residential Care	Charleston	2	2	YES
Charleston	Maple Manor Community Care Home	Residential Care	Charleston	2	2	YES
Charleston	L. Simmons Residential Home	Residential Care	Charleston	2	2	YES
Charleston	My Father's House	Residential Care	Charleston	2	2	YES
Charleston	Hazel's Residential Care Facility	Residential Care	Charleston	2	2	YES
Charleston	Foster's Rest Home	Residential Care	Charleston	2	2	*
Charleston	Randolph's Residential Care Home	Residential Care	Charleston	2	2	YES
Charleston	Regency House	Residential Care	Charleston	2	2	*
Charleston	DCI, Magnolia Court	Renal Dialysis	Charleston	3	3	*
Charleston	Bowles Community Care Home	Residential Care	Mc Clellanville	2	2	YES
Charleston	Salley's Boarding Home	Residential Care	Charleston	2	2	*
Charleston	Bishop Gadsden Episcopal Community	Residential Care	Charleston	2	2	YES
Charleston	MUSC Medical Center	Hospital	Charleston	2	1	YES
Charleston	DCI, Charleston	Renal Dialysis	Charleston	2	2	*

TABLE 3-7. Coastal Health Care Facilities ("*" Indicates Not Located In FEMA Special Flood Hazard Area)

COUNTY	FACILITY NAME	FACILITY TYPE	CITY	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SFHA
Charleston	DOAODA Services of Charleston Co./Subacute Detoxification Pr	Residential Care	Charleston	1	1	YES
Charleston	DOAODA Services of Charleston County - New Life Program	Residential Care	Charleston	1	1	YES
Charleston	DOAODA Services of Charleston County - Family Care Unit	Residential Care	Charleston	1	1	YES
Charleston	Charleston Memorial Hospital	Hospital	Charleston	1	1	YES
Charleston	Roper Hospital, Inc.	Hospital	Charleston	1	1	YES
Charleston	Reid House of Christian Service	Adult Day Care	Charleston	2	2	YES
Charleston	Charleston Plastic Surgery Center	Ambulatory Surgery	Charleston	2	2	YES
Charleston	Franklin C. Fetter Home Health Agency	Home Health	Charleston	2	2	YES
Charleston	Franke Home, Inc.	Residential Care	Mt. Pleasant	3	2	YES
Charleston	Hospice Care of Choice	Hospice	Mt Pleasant	1	1	YES
Charleston	Charleston Nursing Center	Nursing Care	Mt Pleasant	4	3	*
Charleston	Sandpiper Village, Inc.	Residential Care	Mt Pleasant	4	4	*
Charleston	Sandpiper Convalescent Center	Nursing Care	Mt Pleasant	5	4	*
Charleston	Sandpiper Courtyard	Residential Care	Mt Pleasant	4	4	*
Charleston	East Cooper Regional Medical Center	Hospital	Mt Pleasant	3	2	*
Charleston	Cooper Hall	Residential Care	Mt Pleasant	5	4	*
Charleston	Lenevar Community Residence	Mental Retardation Habilitation	Charleston	2	2	*
Charleston	Pelzer's Residential Care	Residential Care	Charleston	1	1	YES
Charleston	Tall Pines Residential Care Home	Residential Care	Charleston	2	2	*
Charleston	Sherman & Wright Residential Care, Inc. #2	Residential Care	Charleston	3	3	*
Charleston	Carter-May Home	Residential Care	Charleston	4	3	*
Charleston	Sherman & Wright Residential Care, Inc. #1	Residential Care	Charleston	3	3	*
Charleston	St. Mark's Community Residential Care	Residential Care	Charleston	3	2	*
Charleston	Heritage Residential Care Home	Residential Care	Charleston	3	2	*
Charleston	Evergreen Residential Care, Inc. I	Residential Care	Charleston	4	3	*
Charleston	Dennis Residential Care Home	Residential Care	Charleston	2	2	*
Charleston	St. Mark's Adult Boarding Home	Residential Care	Charleston	2	2	*
Charleston	Adult Day Care of Charleston	Adult Day Care	Charleston	2	2	YES
Charleston	Roper West Ashley Surgery Center	Ambulatory Surgery	Charleston	2	2	*
Charleston	DCI, West of the Ashley	Renal Dialysis	Charleston	2	2	*
Charleston	Columbia Coastal Carolina Home Health	Home Health	Charleston	2	2	*
Charleston	Roper North Treatment Center	Outpatient Chemical Dependencies	North Charleston	3	2	*
Charleston	Charter Charleston Behavioral Health Systems	Outpatient Chemical Dependencies	Charleston	3	2	*
Charleston	Anne C. Epting, MD	Acupuncture	Charleston	3	2	*

TABLE 3-7. Coastal Health Care Facilities ("*" Indicates Not Located In FEMA Special Flood Hazard Area)

COUNTY	FACILITY NAME	FACILITY TYPE	CITY	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SFHA
Charleston	Roper Home Care Services	Home Health	Charleston	2	2	*
Charleston	Springhouse Manor Care Health Services	Residential Care	Charleston	4	4	*
Charleston	Gadsden Residential Care Home	Residential Care	Charleston	2	2	YES
Charleston	Zeyi Chen	Acupuncture Clinic	Charleston	2	2	*
Charleston	Gadsden Residential Care Home	Residential Care	Charleston	2	2	YES
Charleston	DCI, East of the Cooper	Renal Dialysis	Mt Pleasant	5	4	*
Charleston	Maria's Priority Care Residential Home II-E	Residential Care	Charleston	0	0	*
Charleston	Cabading Homes #1	Residential Care	Charleston	0	0	*
Charleston	DCI, Azalea Place	Renal Dialysis	North Charleston	0	0	*
Charleston	Pettis Angels Residential Care	Residential Care	Charleston	0	0	*
Charleston	Bell's Professional Residential Home Care	Residential Care	Charleston	0	0	*
Charleston	Northwoods Residential Care Facility, Inc.	Residential Care	Charleston	0	0	*
Charleston	My Mother's House	Residential Care	Ladson	0	0	*
Charleston	Bran De Ana's Residential Care II	Residential Care	Charleston	2	2	*
Charleston	Westerlin Residential Care	Residential Care	Charleston	3	2	*
Charleston	Healthsouth Rehabilitation Hospital of Charleston	Hospital	N Charleston	0	0	*
Charleston	North Haven Residential Care Home	Residential Care	North Charleston	5	5	*
Charleston	Northside Residential Care Facility	Residential Care	North Charleston	0	0	*
Charleston	Villa of Charleston Active Day Center	Adult Day Care	North Charleston	0	0	*
Charleston	Life Care Center of Charleston	Nursing Care	North Charleston	0	0	*
Charleston	HealthSouth Surgery Center of Charleston	Ambulatory Surgery	N Charleston	0	0	*
Charleston	Midland Park Adult Day Care	Adult Day Care	North Charleston	0	0	*
Charleston	Midland Park Residential Home Care	Residential Care	North Charleston	0	0	*
Charleston	Laura's Residential Home	Residential Care	Charleston	1	1	YES
Charleston	St. Margaret Street Community Residence	Residential Care	Charleston	1	1	YES
Charleston	Cummings Community Residential Care Home	Residential Care	North Charleston	0	0	*
Charleston	Addison's Residential Care Facility	Residential Care	Charleston	0	0	*
Charleston	Twin Oaks Villa	Residential Care	North Charleston	2	1	*
Charleston	Lambs Road Community Residence	Residential Care	N Charleston	0	0	*
Charleston	Pinehurst Street Community Residence	Mental Retardation Habilitation	Charleston	0	0	*
Charleston	Interim HealthCare of Greater Charleston	Home Health	Charleston	0	0	*
Charleston	Langit's Residential Home Care, Inc. #1	Residential Care	N Charleston	0	0	*
Charleston	Barredo's Community Residential Care	Residential Care	Charleston	0	0	*
Charleston	Maria's Priority Care Residential Home II-F	Residential Care	Charleston	0	0	*

TABLE 3-7. Coastal Health Care Facilities ("*" Indicates Not Located In FEMA Special Flood Hazard Area)

COUNTY	FACILITY NAME	FACILITY TYPE	CITY	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SFHA
Charleston	Maria's Priority Care Residential Home II-B	Residential Care	Charleston	0	0	*
Charleston	Clara Williams Residential Care Facility	Residential Care	North Charleston	0	0	*
Charleston	Constance Residential Adult Care Home	Residential Care	Charleston	3	3	YES
Charleston	Associated Pain Physicians, Inc.	Acupuncture Clinic	Charleston	3	2	*
Charleston	Ambulatory Eye Surgery & Laser Center, Inc.	Ambulatory Surgery	Charleston	0	0	*
Charleston	Trident Ambulatory Surgery Center	Ambulatory Surgery	Charleston	0	0	*
Charleston	Houghton Drive Community Residence	Mental Retardation Habilitation	Charleston	2	2	*
Charleston	Hospice Health Services	Hospice	Charleston	3	3	*
Charleston	Charter Charleston Behavioral Health System	Hospital	N Charleston	3	2	YES
Charleston	Columbia Trident Medical Center	Hospital	Charleston	0	0	*
Charleston	Roper Hospital North, Inc.	Hospital	North Charleston	3	2	YES
Charleston	Bishop Gadsden Episcopal Health Care Center	Nursing Care	Charleston	3	2	YES
Charleston	Columbia Trident Skilled Nursing Care Center	Nursing Care	Charleston	0	0	*
Charleston	Roper Nursing Center	Nursing Care	Charleston	2	2	*
Charleston	White Oak Manor - Charleston	Nursing Care	North Charleston	0	0	*
Charleston	Center for Behavioral Health South Carolina, Inc.	Outpatient Chemical Dependencies	Charleston	0	5	*
Charleston	Trident Behavioral Health Outpatient Center	Outpatient Chemical Dependencies	Charleston	0	0	*
Charleston	Vivra Renal Care of Charleston	Renal Dialysis	Charleston	0	5	*
Charleston	Vivra Renal Care of Trident	Renal Dialysis	North Charleston	0	0	*
Charleston	Bran De Ana's Residential Care	Residential Care	North Charleston	5	4	*
Charleston	Cosgrove Manor	Residential Care	Charleston	0	0	*
Charleston	First Choice Home Care Facility	Residential Care	North Charleston	0	0	*
Charleston	Genesis Community Care Home #1	Residential Care	N Charleston	0	0	*
Charleston	Genesis Community Care Home #3	Residential Care	N Charleston	0	0	*
Charleston	Jade Community Residential Care	Residential Care	Charleston	3	2	YES
Charleston	Reyes Residential Home Care Facility	Residential Care	N Charleston	0	0	*
Charleston	Rivers Avenue Manor	Residential Care	Charleston	0	0	*
Charleston	Vanwyever Residential Care Facility	Residential Care	North Charleston	0	0	*
Charleston	Charter Adolescent Residential Treatment, Charleston	Residential Treatment	Charleston	3	2	YES
Colleton	Forest Circle Community Residence	Mental Retardation Habilitation	Walterboro	0	0	*
Colleton	Colleton Manor	Residential Care	Walterboro	0	0	*
Colleton	Palmetto Care Home, Inc.	Residential Care	Walterboro	0	0	*
Colleton	Oakwood Health Care Center	Nursing Care	Walterboro	0	0	*
Colleton	Josie Drive Community Residence	Mental Retardation Habilitation	Walterboro	0	0	*

TABLE 3-7. Coastal Health Care Facilities ("*" Indicates Not Located In FEMA Special Flood Hazard Area)

COUNTY	FACILITY NAME	FACILITY TYPE	CITY	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SFHA
Colleton	Choice Health Care Services, Inc.	Home Health	Walterboro	0	0	*
Colleton	Colleton Medical Center	Hospital	Walterboro	0	0	*
Colleton	Colleton Medical Center	Nursing Care	Walterboro	0	0	*
Colleton	Vivra Renal Care of Walterboro	Renal Dialysis	Walterboro	0	0	*
Dorchester	Omoooo Community Care Home	Residential Care	Summerville	0	0	*
Dorchester	Summerville Medical Center(Hospital)	Nursing Care	Summerville	0	0	*
Dorchester	Columbia Summerville Medical Center	Hospital	Summerville	0	0	*
Dorchester	Hallmark Healthcare Center	Nursing Care	Summerville	0	0	*
Dorchester	Oakbrook Health & Rehabilitation Center	Nursing Care	Summerville	0	0	*
Dorchester	Royal Oaks Residential Care	Residential Care	Summerville	0	0	*
Dorchester	Terry's Rest Home	Residential Care	Summerville	0	0	*
Dorchester	Dorchester County Rest Home	Residential Care	Summerville	0	0	*
Dorchester	Coastal Center Live Oak Village	Mental Retardation Habilitation	Summerville	0	0	*
Dorchester	Coastal Center-Highlands 510	Mental Retardation Habilitation	Ladson	0	0	*
Dorchester	St. George Health Care Center	Nursing Care	Saint George	0	0	*
Dorchester	Parsons II Group Home	Mental Retardation Habilitation	Summerville	0	0	*
Dorchester	Bridges, A Daytime Adult Program	Adult Day Care	Summerville	0	0	*
Dorchester	New Hope Charleston	Residential Treatment	Summerville	0	0	*
Dorchester	Parsons I Group Home	Mental Retardation Habilitation	Summerville	0	0	*
Dorchester	Coastal Center-Highlands Hillside	Mental Retardation Habilitation	Ladson	0	0	*
Dorchester	Home Health of South Carolina, Inc. - Lowcountry	Home Health	Summerville	0	0	*
Dorchester	Dorchester County Commission on Alcohol & Drug Abuse	Outpatient Chemical Dependencies	Summerville	0	0	*
Georgetown	Bay Microsurgical Unit, Inc.	Ambulatory Surgery	Georgetown	1	1	YES
Georgetown	Jessamine Community Residence	Mental Retardation Habilitation	Georgetown	5	4	*
Georgetown	Maryville Community Residence	Mental Retardation Habilitation	Georgetown	0	0	*
Georgetown	CareSouth - Georgetown, SC	Home Health	Georgetown	5	4	*
Georgetown	Hospice of Georgetown County, Inc.	Hospice	Georgetown	4	3	*
Georgetown	Georgetown County Memorial Hospital	Hospital	Georgetown	4	4	*
Georgetown	Prince George Health Care Center	Nursing Care	Georgetown	0	0	*
Georgetown	Winyah Convalescent Center	Nursing Care	Georgetown	4	4	*
Georgetown	Counseling Center of Georgetown	Outpatient Chemical Dependencies	Georgetown	4	3	*
Georgetown	Georgetown Dialysis Center	Renal Dialysis	Georgetown	4	3	*
Georgetown	Manor House of Georgetown	Residential Care	Georgetown	5	4	*
Hampton	Harper Nursing Center	Nursing Care	Estill	0	0	*

TABLE 3-7. Coastal Health Care Facilities ("*" Indicates Not Located In FEMA Special Flood Hazard Area)

COUNTY	FACILITY NAME	FACILITY TYPE	CITY	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SFHA
Hampton	Furman Residential Care	Residential Care	Furman	0	0	*
Hampton	Hampton Regional Medical Center	Hospital	Varnville	0	0	*
Hampton	Seville's Residential Care Facility	Residential Care	Hampton	0	0	*
Hampton	Hampton Regional Medical Center Dialysis Center	Renal Dialysis	Varnville	0	0	*
Hampton	Bowers Home	Residential Care	Varnville	0	0	*
Horry	Pleasant Grove Manor	Residential Care	Loris	0	0	*
Horry	Conway Nursing Center, Inc.	Nursing Care	Conway	0	0	*
Horry	Pinedale Residential Center of Conway	Residential Care	Conway	0	0	*
Horry	Conway Dialysis Center	Renal Dialysis	Conway	0	0	*
Horry	Coastal Carolina Hospital, Buildings 300 & 400	Hospital	Conway	0	0	*
Horry	Compass Transitional Care	Nursing Care	Conway	0	0	*
Horry	Jordan's Residential Care, Inc.	Residential Care	Conway	0	0	YES
Horry	NHC HealthCare, Garden City	Nursing Care	Murrells Inlet	0	0	*
Horry	InCare Home Health, Inc.	Home Health	Myrtle Beach	0	0	*
Horry	Grand Strand Healthcare	Nursing Care	Myrtle Beach	0	5	*
Horry	Interim HealthCare of the Eastern Carolinas, Inc.	Home Health	Myrtle Beach	0	0	*
Horry	Nursepro, Inc.	Hospice	Myrtle Beach	0	5	*
Horry	Comprehensive Home Health Care I, Inc.	Home Health	Myrtle Beach	0	5	*
Horry	Traditional and Alternative Medicine	Acupuncture	Myrtle Beach	0	0	*
Horry	Myrtle Beach Dialysis Center	Renal Dialysis	Myrtle Beach	0	0	*
Horry	Adult Day Care of the Grand Strand	Adult Day Care	Myrtle Beach	0	0	*
Horry	Covenant Towers Health Care	Nursing Care	Myrtle Beach	0	5	*
Horry	Myrtle Beach Manor	Nursing Care	Myrtle Beach	0	0	*
Horry	Myrtle Beach Manor Retirement Community Assisted living	Residential Care	Myrtle Beach	0	0	*
Horry	Carolina Regional Surgery Center, Ltd.	Ambulatory Surgery	Myrtle Beach	0	0	*
Horry	Mercy Home Care	Home Health	Myrtle Beach	0	5	*
Horry	Mercy Hospice of Horry County	Hospice	Myrtle Beach	0	5	*
Horry	Atlantic Healthcare Group Adult Medical Day Care	Adult Day Care	Myrtle Beach	0	0	*
Horry	Loris Community Hospital	Hospital	Loris	0	0	*
Horry	Loris Extended Care Center	Nursing Care	Loris	0	0	*
Horry	Total Care, Inc. - Coastal	Home Health	Surfside Beach	5	4	*
Horry	Villa at the Beach Active Day Center	Adult Day Care	Surfside Beach	0	5	*
Horry	Waccamaw Home Health Services	Home Health	Conway	0	0	*
Horry	Kingston Nursing Center	Nursing Care	Conway	0	0	*

TABLE 3-7. Coastal Health Care Facilities ("*" Indicates Not Located In FEMA Special Flood Hazard Area)

COUNTY	FACILITY NAME	FACILITY TYPE	CITY	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SFHA
Horry	Horry County Commission on Alcohol & Drug Abuse	Outpatient Chemical Dependencies	Conway	0	0	*
Horry	Loris Dialysis Center	Renal Dialysis	Loris	0	0	*
Horry	Horry County Commission on Alcohol & Drug Abuse/Residential	Residential Care	Conway	0	0	*
Horry	Coastal Carolina Residential Treatment Center	Residential Treatment	Conway	0	0	*
Jasper	Ridgeland Correctional Institute Infirmary	Hospital	Ridgeland	0	0	*
Jasper	Low Country General Hospital	Hospital	Ridgeland	0	0	*
Jasper	Ridgeland Nursing Center Inc.	Nursing Care	Ridgeland	0	0	*
Jasper	Medi Home Health of Low Country General Hospital	Home Health	Ridgeland	0	0	*
Jasper	Adult Day Care of Ridgeland, Inc.	Adult Day Care	Ridgeland	0	0	*

TABLE 3-8. Coastal Law Enforcement ("*" Indicates Not Located In FEMA Special Flood Hazard Area)

Data Source Category ("0" = Address Matching Was Used "1" = GPS Was Used)

COUNTY	FACILITY NAME	FACILITY TYPE	CITY	DATA SOURCE	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SPFA
Beaufort	Beaufort County Sheriff	Law	Beaufort	0	5	4	*
Beaufort	Beaufort Police Dept	Law	Beaufort	0	5	4	*
Beaufort	Blufton Police Dept	Law	Bluffton	0	0	4	*
Beaufort	Port Royal Public Safety	Law	Port Royal	0	4	3	*
Berkeley	Berkeley County Sheriff	Law	Moncks Corner	0	0	0	*
Berkeley	Hanahan Police Dept	Law	Hanahan	0	0	0	*
Berkeley	Jamestown Police Dept	Law	Jamestown	0	0	0	*
Berkeley	Lincolnville Police Dept	Law	Lincolnville	0	0	0	*
Berkeley	Santee Cooper Law Enforcement	Law	Moncks Corner	0	0	0	*
Berkeley	St. Stephens Police Dept	Law	St. Stephen	0	0	0	*
Charleston	Charleston City Police Dept	Law	Charleston	0	1	1	YES
Charleston	Citadel Public Safety	Law	Charleston	0	3	3	YES
Charleston	County Jail Annex	Law	N Charleston	1	4	4	YES
Charleston	County Jail-New	Law	N. Charleston	1	4	4	YES
Charleston	County Jail-Old	Law	N. Charleston	1	4	4	YES
Charleston	County Sheriff	Law	N Charleston	1	0	0	*
Charleston	Folly Beach Public Safety	Law	Folly Beach	0	2	1	YES
Charleston	Isle of Palms Police Dept	Law	Isle of Palms	0	2	2	YES
Charleston	Juvenile Detention	Law	N Charleston	1	1	1	YES
Charleston	Metro Police Office	Law	N. Charleston	1	3	2	YES
Charleston	Metro Police Warehouse	Law	N. Charleston	1	3	2	YES
Charleston	Mt. Pleasant Police Dept	Law	Mt. Pleasant	0	5	4	*
Charleston	N Charleston Police Dept	Law	Mt Pleasant	1	0	5	*
Charleston	North Charleston Police Dept	Law	N. Charleston	0	5	5	YES
Charleston	Police Headquarters	Law	N. Charleston	1	0	0	*
Charleston	Police Headquarters Annex	Law	N. Charleston	1	0	0	*
Charleston	Police Impoundment	Law	N. Charleston	1	0	0	*
Charleston	Police Offices-3 Mod. Units	Law	N. Charleston	1	0	0	*
Charleston	Police Storeroom	Law	N. Charleston	1	0	0	*
Charleston	Police Sub Station #2	Law	St. Paul	1	0	0	*
Charleston	Police Substation #4	Law	James Island	1	2	2	YES
Charleston	Police Sub-Station Antenna	Law	Adams Run	1	0	0	*

TABLE 3-8. Coastal Law Enforcement ("*" Indicates Not Located In FEMA Special Flood Hazard Area)
Data Source Category ("0" = Address Matching Was Used "1" = GPS Was Used)

COUNTY	FACILITY NAME	FACILITY TYPE	CITY	DATA SOURCE	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SPFA
Charleston	Sherriff's Office	Law	Ravenal	1	0	0	*
Charleston	Sullivans Island Police Dept	Law	Sullivans Island	0	1	1	YES
Charleston	Temporary Jail	Law	N Charleston	1	4	4	YES
Charleston	Trident Tech College Public Safet	Law	N. Charleston	0	0	0	*
Charleston	Work Camp	Law	N Charleston	1	3	2	YES
Colleton	Colleton County Sherrif's Office	Law	Walterboro	1	0	0	*
Colleton	Cottageville Police Dept	Law	Cottageville	0	0	0	*
Colleton	Edisto Beach Police Dept	Law	Edisto Beach	0	2	1	YES
Colleton	Walterboro Police Dept	Law	Walterboro	0	0	0	*
Dorchester	Dorchester County Sheriff	Law	Summerville	0	0	0	*
Dorchester	Harleyville Police Dept	Law	Harleyville	0	0	0	*
Dorchester	Ridgeville Police Dept	Law	Ridgeville	0	0	0	*
Dorchester	St. George Police Dept	Law	St. George	0	0	0	*
Georgetown	Andrews Police	Law	Andrews	1	0	0	*
Georgetown	County Jail	Law	Georgetown	1	5	5	YES
Georgetown	County Sheriff Office	Law	Georgetown	1	4	4	*
Georgetown	Georgetown County Sheriff	Law	Georgetown	0	4	4	*
Georgetown	Georgetown Police Dept	Law	Georgetown	1	4	4	YES
Georgetown	Pawley's Island Police Dept	Law	Pawley's Island	0	1	1	YES
Hampton	Brunson Police Dept	Law	Brunson	0	0	0	*
Hampton	Estill Police Dept	Law	Estill	0	0	0	*
Hampton	Gifford Police Dept	Law	Gifford	0	0	0	*
Hampton	Hampton County Sheriff	Law	Hampton	0	0	0	*
Hampton	Hampton Police Dept	Law	Hampton	0	0	0	*
Hampton	Varnville Police Dept	Law	Varnville	0	0	0	*
Hampton	Yemassee Town Police Dept	Law	Yemassee	0	0	0	*
Horry	Aynor Police Dept	Law	Aynor	0	0	0	*
Horry	Briarcliff Acres Police Dept	Law	N. Myrtle Beach	0	0	5	*
Horry	Coastal Carolina College PS	Law	Conway	0	0	0	*
Horry	Conway Law Enf Center	Law	Conway	1	0	0	*
Horry	Horry County Police Dept	Law	Conway	0	0	0	*
Horry	Horry County Sheriff	Law	Conway	0	0	0	*
Horry	J Reuben Long Detention Facility	Law	Conway	1	0	0	*
Horry	Loris Police Dept	Law	Loris	0	0	0	*

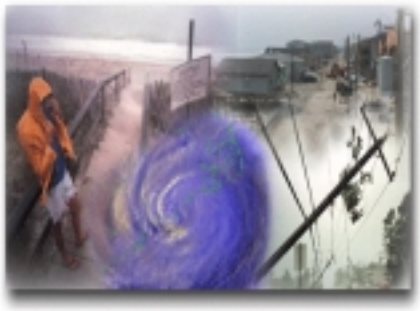
TABLE 3-8. Coastal Law Enforcement ("*" Indicates Not Located In FEMA Special Flood Hazard Area)

Data Source Category ("0" = Address Matching Was Used "1" = GPS Was Used)

COUNTY	FACILITY NAME	FACILITY TYPE	CITY	DATA SOURCE	NORMAL STORM SURGE	FAST STORM SURGE	FEMA SPFA
Horry	Myrtle Beach Law Enforcement Cent	Law	Myrtle Beach	1	0	0	*
Horry	N Myrtle Beach Public Safety	Law	N Myrtle Beach	0	0	0	*
Horry	Surfside Beach Police Dept	Law	Surfside Beach	0	0	5	*
Jasper	Hardeeville Police Dept	Law	Hardeeville	0	0	0	*
Jasper	Jasper County Jail	Law	Ridgeland	1	0	0	*
Jasper	Jasper County Sheriff	Law	Ridgeland	0	0	0	*
Jasper	Ridgeland Police Dept	Law	Ridgeland	0	0	0	*

CHAPTER FOUR - BEHAVIORAL ASSUMPTIONS

4.1 Behavioral Assumptions



Recognizing that a future evacuation of the South Carolina study area will involve the evacuation participation decisions of thousands of individuals and households, the post hurricanes Bertha/Fran (1996) evacuation behavioral surveys were reviewed and analyses conducted for the northern conglomerate and post behavioral work done in other coastal states. Preliminary post hurricane Floyd (1999) evacuation statistics were also considered. As sources of data were reviewed, effort was concentrated on data related to the following behavioral aspects:

- Participation rates - what percent of the population in different areas will evacuate their dwelling units for future hurricane threats?

- Evacuation rapidity of response rates - how quickly will evacuees respond to what local officials are telling them to do?

- Destination percentages - what percent of the population by county sub-area will evacuate to local public shelters, local hotel/motels, local friends' and relatives' homes, or out of the county entirely?

- Vehicle usage - of the vehicles available to the households, what percent of those vehicles will be used in an evacuation?

Behavioral assumptions were developed by zone relying on the following sources of input:

- Discussions concerning expected behavioral response with emergency management staff in each county

- Review of past behavioral studies as a part of various hurricane planning efforts conducted by the U.S. Army Corps of Engineers, and FEMA.

- Behavioral research by Hazards Management Group for the region;

particularly behavioral data collected for the 1996 Bertha/Fran responses in Horry County.

Even with these resources, a great deal of judgment was involved in developing the needed parameters on a zone by zone basis. This was in part due to the state and local decision to forgo a formal study behavioral analysis as a part of the Corps of Engineer's restudy process. However, previous studies both pre- and post-storm around the country can be used in developing and applying behavioral parameters for evacuation analysis.

Key assumptions by zone were specified by scenario before modeling commenced. Summary sheets of all key assumptions are provided in the evacuating people and vehicle/trip generation portion of the Transportation Model Support Document. This document will be provided to the State, along with the final version of the Transportation Analysis from PBS&J. Participation rates assumed for all zones in a county and for each scenario are provided in the model document as well. Key factors behind the participation assumptions are as follows:

- Zones that will be evacuated for storm surge were assumed to have a 100% participation rate. Even though in actuality these rates will be lower, as a matter of public safety the clearance times calculated in this study should allow those who are vulnerable to storm surge the opportunity to evacuate whether they choose to or not.

- All mobile homes in inland zones and counties are assumed to evacuate.

- A portion of the theoretically non-vulnerable population was also assumed to evacuate in the modeling. This percentage could be higher than what was used particularly for more intense hurricanes (1% - 15%), but will be balanced out with the less than 100% of surge residents who will participate in an actual event.

A critical behavioral aspect that must be considered for the transportation analysis is the rapidity of evacuation response of the evacuating population. Behavioral data from research of past hurricane evacuation shows that mobilization and actual departures of the evacuating population can occur over a period of many hours or over a very brief time. In the Bertha/Fran evacuations, evacuees loaded the road network over a long period of time due to the meteorology and path of the storm. In Floyd, traffic loaded the road network very quickly. Traffic counts provided by SCDOT have helped tremendously in ascertaining behavioral response in the coastal areas of South Carolina.

For the South Carolina restudy, clearance times were tested for three evacuation response rates represented by different behavioral response curves. Behavioral response curves

describing mobilization by the vulnerable population define the rate at which evacuating vehicles attempt to load onto the evacuation street network for each hourly interval relative to an evacuation order or advisory. These response curves shown in Figure 4-1 range from rapid response to long response and are intended to include a range of possible mobilization times that might be experienced in a future hurricane evacuation situation. For sensitivity analysis, the mobilization/traffic loading time was varied between five hours and eleven hours.

The percentage of evacuees assumed to go to one of four general destination types was another important behavioral input to the transportation analysis. Evacuee destination percentages were discussed in local meetings and after review of various sources of behavioral information, assumptions were developed by zone. Figures were developed for the expected percent of evacuees going to local public shelters, hotel/motel units, the home of a friend or relative, or out of the county entirely. Destination percentages were varied for each zone in the county depending on category of risk (distance from coastline) or special characteristics of a zone such as high number of mobile home units. Different assumptions were made for permanent residents versus tourists.

It should be noted that destination percentages refer to destination desires. Where destination desires could not be satisfied by in-county capacities (e.g., hotel/motels), the transportation analysis assumed that these evacuees would have to leave the county to find acceptable refuge. One important behavioral aspect built into the rates is that of a larger percentage of evacuees going out-of-county for each successive step in storm intensity scenario. The analysis recognized that, in the lower intensity scenarios in the non-surge area, most of the evacuees are mobile home residents who have a higher propensity to use local public shelters.

Visitor profiles developed by chamber of commerce and regional planning groups provided help with out-of-county evacuee assumptions particularly for the northern and coastal conglomerates. Table 4-1 provides a listing of home states of tourists which may influence the direction and routes of out-of-county evacuees.

A final behavioral assumption refers to vehicle usage during the evacuation. Vehicle usage percentages refer to the percentage of vehicles available at the home origin that are assumed to be used in the evacuation. Vehicle usage percentages were 65% to 75% (depending on distance from the coastline) for the study transportation analysis. These statistics were observed in the Floyd evacuation during the fall of 1999.

Section 4.2 summarizes the key behavioral concepts and assumptions used in the study. The Transportation Model Support Document provides all of the specific parameters used for each zone and county for all scenarios.

Figure 4-1. Behavioral Response Curves

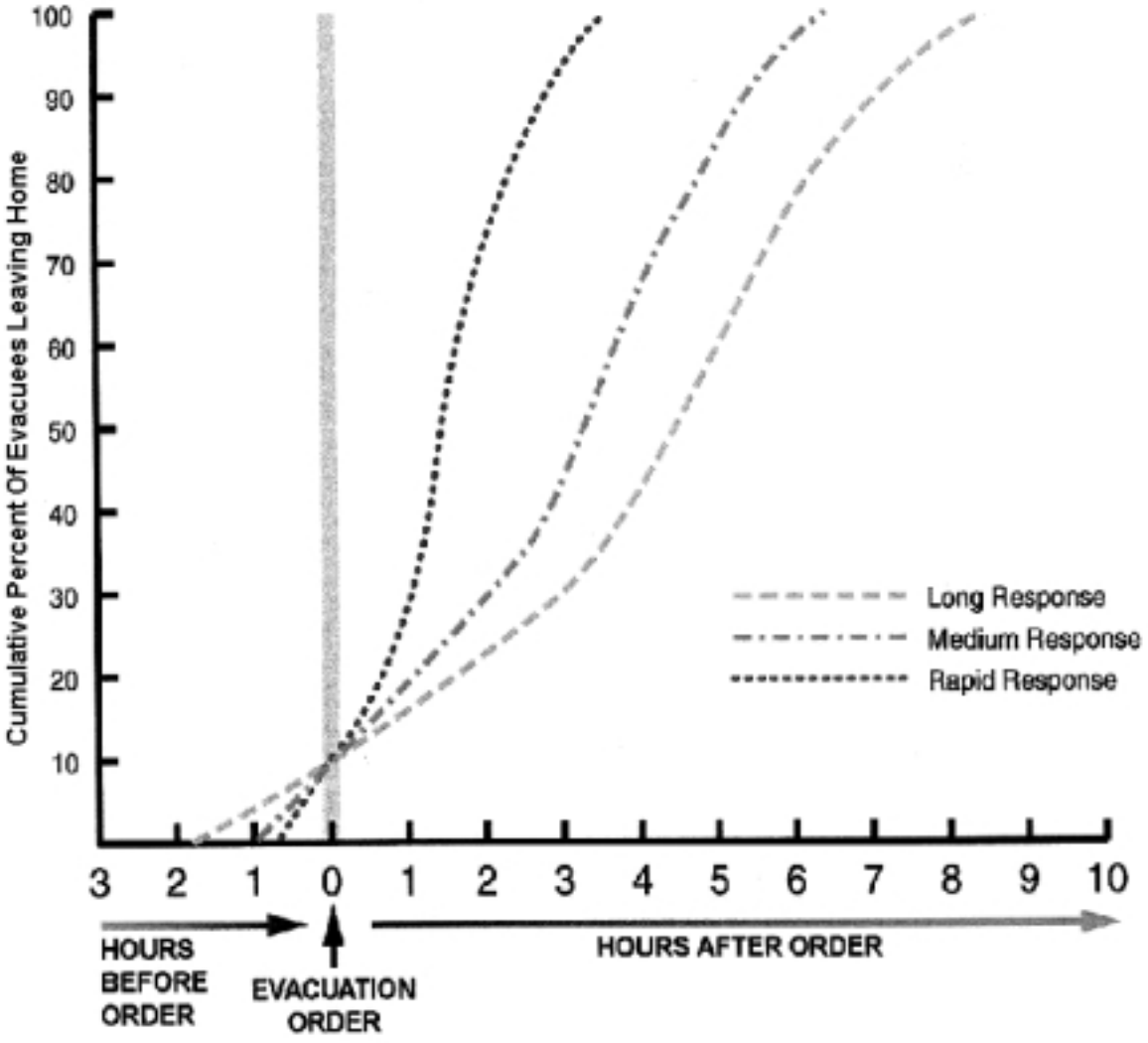


Table 4-1. Visitor Profile Home States Influencing Out-Of-County Movements

HOME STATES	**PERCENTAGE OF TOURISTS**
Illinois, Indiana, Ohio, Kentucky	13%
Georgia, Tennessee	7%
North Carolina	25%
South Carolina Inland	14%
Virginia, West Virginia	13%
Maryland, New York, Pennsylvania, New England	17%
Canada	2%
Other	9%

4.2. Summary of Behavioral Assumptions

Participation Rates

Assumptions had to be made about what percent of the population is leaving their home dwelling unit in different areas of each county for various strengths of hurricanes. Although we know that even for the most intense hurricanes it is unlikely that 100% of the people we ask to evacuate will evacuate, it was decided that we assume the following for each scenario:

> 100% participation of storm surge evacuation areas plus all mobile homes and a small portion of the theoretically non-vulnerable population.

Clearance times calculated in the transportation analysis under this assumption give vulnerable residents the opportunity to evacuate whether they choose to or not.

Destination Percentages

Assumptions also had to be made about what percent of the evacuees will go to in-county public shelter, in-county homes of friends/relative (including churches, masonic lodges), in county hotel/motels, or out of the county entirely. Assumptions are made for evacuation zones with similar characteristics (e.g. barrier islands) within each county. Based on observations of past evacuations in South Carolina and other coastal areas around the country, it was decided that we use the following ranges of values:

Of those evacuating

Percent to Local Public Shelter -	3-5 of high risk areas (beachfront, barrier islands)
	10-15% of moderate risk areas (category 2-3 zones)
	15-25% of low risk area depending upon income
Percent to Out-of-County -	40-70% in strong storm depending upon risk area and income
	30-50% in a weak storm depending upon risk area and income

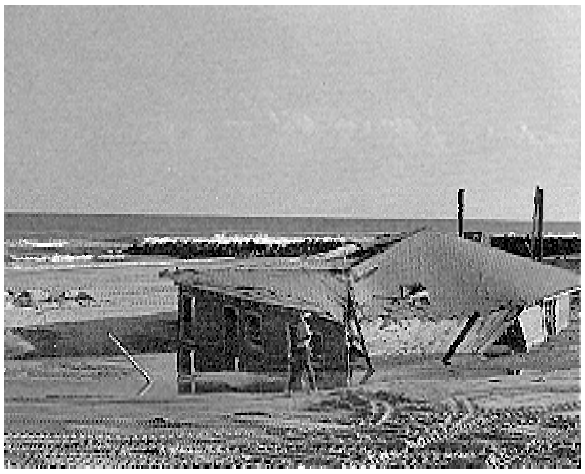
Remainder to In-County Friends and Relatives Homes and Hotel/Motels

Vehicle Utilization

Evacuees will use 65-75% of the vehicles available at the household level depending upon risk area. This is pretty constant from one evacuation to another.

CHAPTER FIVE - SHELTER ANALYSIS

5.1 PURPOSE



The general purpose of the shelter analysis is to estimate the number of evacuees that will seek public shelter and determine the number of shelter spaces available. This information is used by County and State emergency management offices to develop a management plan for shelter operation to ensure that the evacuees seeking public shelter will have adequate and safe shelter space. The shelter data is also used in the transportation analysis to calculate clearance times. The Transportation Analysis is covered in Chapter 6.

5.2 SHELTER ANALYSIS

The shelter analysis discusses shelter locations, vulnerability, capacity, and demand. Data developed in the hazards, vulnerability and behavioral analyses were used to evaluate shelter criteria. It is important to note that the identification of a shelter in this report does not indicate that the facility will be used in a given hurricane evacuation. The locations of public shelters are coordinated between emergency management and the American Red Cross. The opening of shelters is based on the hurricane threat and evacuation decisions. Furthermore, shelter designation may change based on new construction, structure modifications, ownership changes or other factors impacting shelter selection. The following paragraphs will discuss shelter vulnerability, shelter demand (number of evacuees seeking public shelter) and shelter inventories and capacities. This portion of the report will be periodically updated by County or State offices to reflect current shelter inventories.

5.2.1 Shelter Vulnerability

Criteria contained in American Red Cross (ARC) publication 4496, Guidelines for Hurricane Evacuation Shelter Selection, dated July 1992, is the tool used to pre-designate hurricane evacuation public shelters opened with ARC and state resources. Working with local and state emergency management, the ARC has reviewed areas of potential flooding shown on surge inundation maps in relationship to public shelter locations. **It is vitally important that any government or private entity intending to operate a public hurricane shelter carefully consider the ARC guidelines and ensure that the shelter is above any storm surge elevations.**

5.2.2 Shelter Demand

Public shelter demand (number of evacuees seeking public shelter) has been calculated for several hurricane evacuation scenarios for each county. These evacuation zone scenarios are discussed for each county in Chapter 3. Generally the percent of evacuees planning to use public shelters ranges from 5-15 % depending upon their risk zone, the storm intensity and their income. Table 5-1 shows the numbers of people estimated to leave dwelling units in both coastal and inland counties for each storm scenario. Mobile home evacuation statistics are also shown in this table for both coastal and inland counties. No out-of-county evacuees are expected to seek shelter in the coastal counties. The analysis assumes an adequate warning period for an approaching hurricane and sufficient public knowledge concerning the locations of shelters.

Table 5-1

EVACUATION STATISTICS BY SCENARIO
Northern Conglomerate Counties
South Carolina Hurricane Evacuation Restudy

COUNTY YEAR 2000 PERMANENT RESIDENT		A MAXIMUM TOTAL EVACUEES	B PERMANENT RESIDENT MOBILE HOME EVACUEES	C IN-COUNTY MAXIMUM PUBLIC SHELTER	D % OF EVACUEES GOING TO PUBLIC SHELTERS
POPULATION	**STORM SCENARIO**	**RESIDENTS AND TOURISTS**	**(SUBSET OF COLUMN A)**	**DEMAND**	**PERCENT**
GEORGETOWN 53,700 People	Category 1-2 Hurricane low tourist occupancy	39,800 people	19,100 people	2,795 people	7.0
	Category 1-2 Hurricane high tourist occupancy	47,700 people	19,100 people	3,050 people	6.4
	Category 3 Hurricane low tourist occupancy	46,900 people	19,100 people	3,450 people	7.4
	Category 3 Hurricane high tourist occupancy	55,900 people	19,100 people	3,530 people	6.3
	Category 4-5 Hurricane low tourist occupancy	55,700 people	19,100 people	4,800 people	8.6
	Category 4-5 Hurricane high tourist occupancy	65,200 people	19,100 people	4,900 people	7.5
	(Low occupancy = 40% of tourist units; high occupancy = 90% of tourist units)				
HORRY 199,700 People	Category 1-2 Hurricane low tourist occupancy	128,800 people	26,100 people	6,100 people	4.7
	Category 1-2 Hurricane high tourist occupancy	205,700 people	26,100 people	6,870 people	3.3
	Category 3-4 Hurricane low tourist occupancy	177,700 people	26,100 people	9,400 people	5.3
	Category 3-4 Hurricane high tourist occupancy	262,650 people	26,100 people	10,250 people	3.9
	Category 5 Hurricane low tourist occupancy	201,200 people	26,100 people	13,450 people	6.7
	Category 5 Hurricane high tourist occupancy	286,100 people	26,100 people	14,300 people	5.0
	(Low occupancy = 40% of tourist units; high occupancy = 90% of tourist units; column B is permanent resident mobile home evacuees)				

Please Note: All figures should be considered maximums for planning purposes as 100% participation is assumed for mobile home and surge zone residents and tourists. In addition, a small portion of the theoretically non-vulnerable population is assumed to participate in the evacuation.

Table 5-1 (Continued)

EVACUATION STATISTICS BY SCENARIO
Northern Conglomerate Counties
South Carolina Hurricane Evacuation Restudy

INLAND COUNTY	YEAR 2000 MOBILE HOME	YEAR 2000 MOBILE HOME POPULATION	IN-COUNTY MAXIMUM PUBLIC SHELTER DEMAND	% OF MOBILE HOME POPULATION GOING TO PUBLIC SHELTERS
CLARENDEN	4,300 units	12,800 people	1,920 people	15
DARLINGTON	7,920 units	22,300 people	3,345 people	15
DILLON	3,800 units	11,200 people	2,240 people	20
FLORENCE	13,390 units	38,000 people	5,700 people	15
LEE	2,000 units	6,100 people	915 people	15
MARLBORO	2,500 units	7,300 people	1,095 people	15
MARION	3,000 units	8,600 people	1,290 people	15
SUMTER	10,500 units	32,400 people	8,100 people	25
WILLIAMSBURG	7,880 units	23,900 people	4,780 people	20

Table 5-1 (Continued)

EVACUATION STATISTICS BY SCENARIO
Central Conglomerate Counties
South Carolina Hurricane Evacuation Restudy

COUNTY YEAR 2000 PERMANENT RESIDENT		A MAXIMUM TOTAL EVACUEES	B MOBILE HOME RESIDENT EVACUEES	C IN-COUNTY MAXIMUM PUBLIC SHELTER	D % OF EVACUEES GOING TO PUBLIC SHELTERS
POPULATION	**STORM SCENARIO**	**RESIDENTS AND TOURISTS**	**(SUBSET OF COLUMN A)**	**DEMAND**	**PERCENT**
CHARLESTON 311,700 People	Category 1 Hurricane low tourist occupancy	164,600 people	33,500 people	10,150 people	6.2
	Category 1 Hurricane high tourist occupancy	186,100 people	33,500 people	10,600 people	5.7
	Category 2 Hurricane low tourist occupancy	213,500 people	33,500 people	14,900 people	7.0
	Category 2 Hurricane high tourist occupancy	244,800 people	33,500 people	15,500 people	6.3
	Category 3 Hurricane low tourist occupancy	285,500 people	33,500 people	25,550 people	8.9
	Category 3 Hurricane high tourist occupancy	318,800 people	33,500 people	26,280 people	8.2
	Category 4-5 Hurricane low tourist occupancy	290,350 people	33,500 people	27,250 people	9.4
	Category 4-5 Hurricane high tourist occupancy	324,700 people	33,500 people	27,900 people	8.6
	(Low occupancy = 30% of tourist units; high occupancy = 90% of tourist units)				
DORCHESTER 97,800 People	Category 1-2 Hurricane	19,750 people	17,700 people	2,900 people	14.7
	Category 3-5 Hurricane	26,580 people	17,700 people	5,160 people	19.4
BERKELEY 149,100 People	Category 1-3 Hurricane	53,850 people	44,000 people	6,700 people	12.0
	Category 4-5 Hurricane	68,000 people	44,000 people	9,950 people	14.6
COLLETON	(See Southern Conglomerate Stats)				
	(Low occupancy = 30% of tourist units; high occupancy = 90% of tourist units)				

Please Note: All figures should be considered maximums for planning purposes as 100% participation is assumed for mobile home and surge zone residents and tourists. In addition, a small portion of the theoretically non-vulnerable population is assumed to participate in the evacuation.

INLAND COUNTY	YEAR 2000 MOBILE HOMES	YEAR 2000 MOBILE HOME POPULATION	IN-COUNTY MAXIMUM PUBLIC SHELTER DEMAND	% OF MOBILE HOME POPULATION GOING TO PUBLIC SHELTERS
CALHOUN	2,000 units	5,680 people	850 people	15
LEXINGTON	15,000 units	40,800 people	6,120 people	15
ORANGEBURG	10,000 units	29,300 people	4,395 people	15
RICHLAND	10,000 units	28,200 people	4,230 people	15

Table 5-1 (Continued)

EVACUATION STATISTICS BY SCENARIO
Southern Conglomerate Counties
South Carolina Hurricane Evacuation Restudy

COUNTY YEAR 2000 PERMANENT RESIDENT		A MAXIMUM TOTAL EVACUEES	B MOBILE HOME RESIDENT EVACUEES	C IN-COUNTY MAXIMUM PUBLIC SHELTER	D % OF EVACUEES GOING TO PUBLIC SHELTERS
POPULATION	**STORM SCENARIO**	**RESIDENTS AND TOURISTS**	**(SUBSET OF COLUMN A)**	**DEMAND**	**PERCENT**
JASPER 18,200 People	Category 1-2 Hurricane	8,150 people	5,700 people	800 people	9.8
	Category 3-5 Hurricane	13,150 people	5,700 people	1,450 people	11.0
BEAUFORT 109,200 People	Category 1 Hurricane low tourist occupancy	72,800 people	27,000 people	4,550 people	6.3
	Category 1 Hurricane high tourist occupancy	101,000 people	27,000 people	4,850 people	4.8
	Category 2-3 Hurricane low tourist occupancy	102,500 people	27,000 people	7,700 people	7.5
	Category 2-3 Hurricane high tourist occupancy	134,100 people	27,000 people	8,000 people	6.0
	Category 4-5 Hurricane low tourist occupancy	128,400 people	27,000 people	10,800 people	8.4
	Category 4-5 Hurricane high tourist occupancy	161,200 people	27,000 people	11,150 people	7.0
	(Low occupancy = 30% of tourist units; high occupancy = 90% of tourist units)				
COLLETON 38,600 People	Category 1 Hurricane low tourist occupancy	21,500 people	18,950 people	2,600 people	12.1
	Category 1 Hurricane high tourist occupancy	24,000 people	18,950 people	2,700 people	11.3
	Category 2-5 Hurricane low tourist occupancy	23,470 people	18,950 people	3,600 people	15.3
	Category 2-5 Hurricane high tourist occupancy	26,650 people	18,950 people	3,700 people	13.9
	(Low occupancy = 30% of tourist units; high occupancy = 90% of tourist units)				

Please Note: All figures should be considered maximums for planning purposes as 100% participation is assumed for mobile home and surge zone residents and tourists. In addition, a small portion of the theoretically non-vulnerable population is assumed to participate in the evacuation.

INLAND COUNTY	YEAR 2000 MOBILE HOME	YEAR 2000 MOBILE HOME POPULATION	IN-COUNTY MAXIMUM PUBLIC SHELTER DEMAND	% OF MOBILE HOME POPULATION GOING TO PUBLIC SHELTERS
AIKEN	12,940 units	34,900 people	5,235 people	15
ALLENDALE	1,000 units	3,090 people	465 people	15
BAMBERG	1,700 units	5,150 people	775 people	15
BARNWELL	3,600 units	10,300 people	1,545 people	15
HAMPTON	3,200 units	9,200 people	1,380 people	15
ORANGEBURG	10,000 units	29,300 people	4,395 people	15

5.2.3 Public Shelter Demand/Capacity Considerations

In terms of public shelter demand and available capacity, except for Beaufort County, each county has appropriate in-county public shelter capacity for the lower to medium categories of hurricanes. However, in the most intense scenario where there is a large tourist population, some of the more populated counties could have deficits and will need help from neighboring inland counties. Table 5-1 (previously shown) provides estimates of in-county maximum public shelter demand for all storm and tourist occupancy scenarios. The public shelter list (June 1999) for each county, from the state hurricane plan, included shelter locations and capacities. Table 5-2 shows potential (Category 4-5) worst case public shelter demand and reported capacities. In the Transportation Analysis, where local capacity was used up, Beaufort County excess shelter demand was taken to Hampton County, Charleston County excess shelter demand was taken to Dorchester County, and Horry/Georgetown Counties excess shelter demand was taken to Williamsburg, Marion and Florence Counties. In reality, local churches and civic groups will help with some of the evacuees who otherwise would be in public shelters.

Table 5-3, shows an inventory of facilities for use as potential hurricane evacuation shelters, including shelter name, city, county, geographic location, and first floor elevation in NAVD 88 (feet). Table 5-4 shows the potential of shelters being vulnerable to hurricane storm surge and located in the FEMA Special Flood Hazard Area. Normal speed storm surge and Fast speed storm surge inundation maps were used to determine the location of shelters relative to different storm category surge heights. Analysis of shelter locations relative to the FEMA Special Flood Hazard Areas (SFHA) was also performed. Tables 5-5 trough 5-12 show inventories of facilities for use as potential hurricane evacuation shelters that meet the American Red Cross guidelines for each coastal county, including the first floor elevation in NAVD 88 (feet).

Figures 5-1 through 5-17 illustrate the range of public shelter demand by zone for the storm scenarios. As the counties continue to grow, the need for in-county public shelter space may become greater, particularly if growth in mobile homes continues. Mobile home residents typically have a higher propensity to use local public shelter space than other residents.

Table 5-2.

WORST CASE PUBLIC SHELTER DEMAND
VERSUS IN-COUNTY CAPACITIES
South Carolina Hurricane Evacuation Restudy

COASTAL COUNTY	WORST CASE CATEGORY 4-5 PUBLIC SHELTER DEMAND	IN-COUNTY PUBLIC SHELTER CAPACITY		
		Voluntary/Mandatory	Supplemental	Total
Horry	14,300 people	6,293	0	6,293 people
Georgetown	4,900 people	3,300	0	3,300 people
Charleston	27,900 people	14,614	7,155	21,769 people
Dorchester	5,160 people	12,725	16,526	29,251 people
Berkeley	9,950 people	5,862	4,000 (est.)	9,862 people
Jasper	1,450 people	1,362	1,800	3,162 people
Beaufort	11,150 people	0	3,944	3,944 people
Colleton	3,700 people	3,582	0	3,582 people

* State defined emergency capacities from South Carolina 1999 Hurricane Plan used in table. Due to construction and other operational considerations, the shelter locations area annually reviewed and updated if necessary.

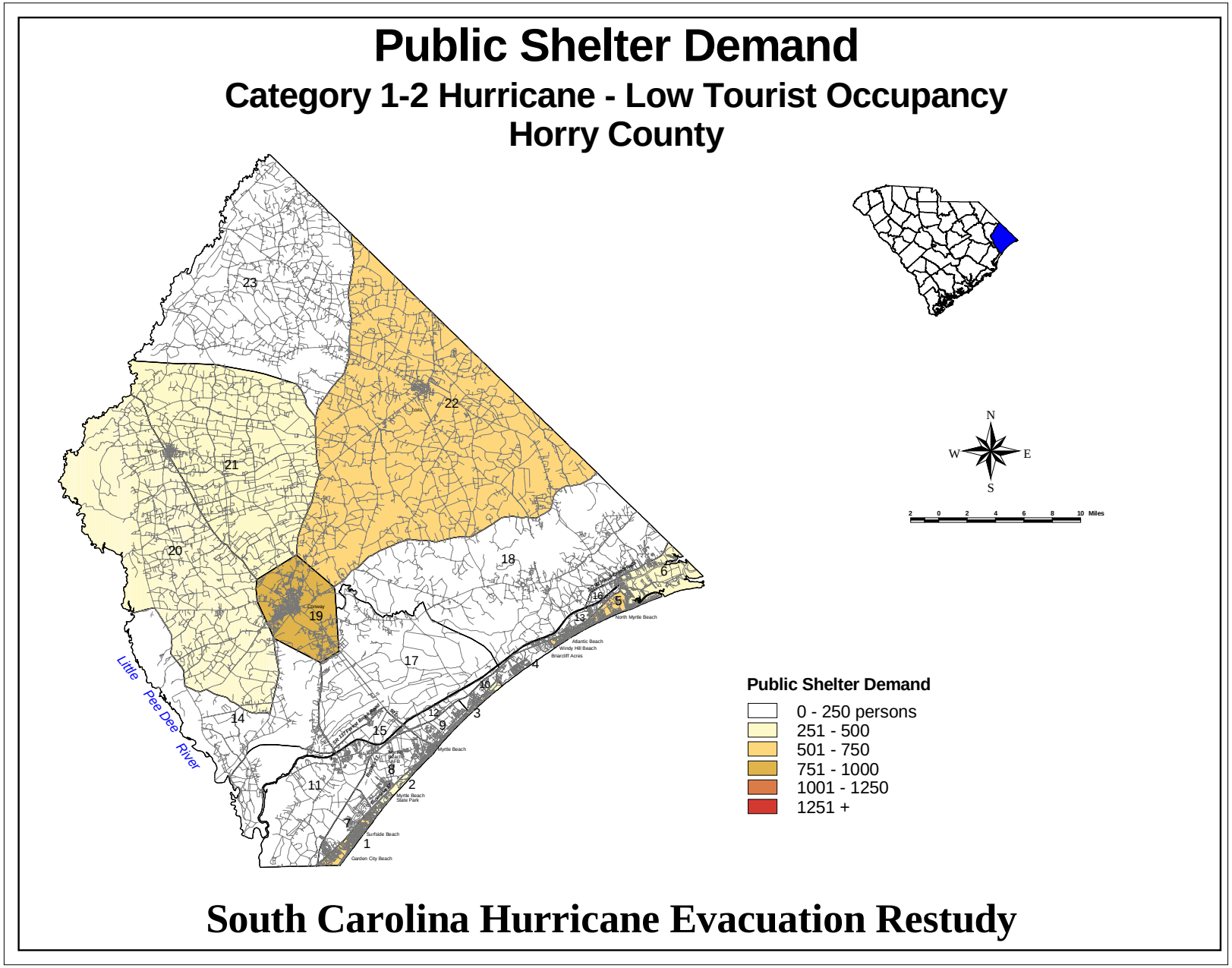


Figure 5-1. Public Shelter Demand Category 5 Hurricane High Tourist Occupancy, Horry County

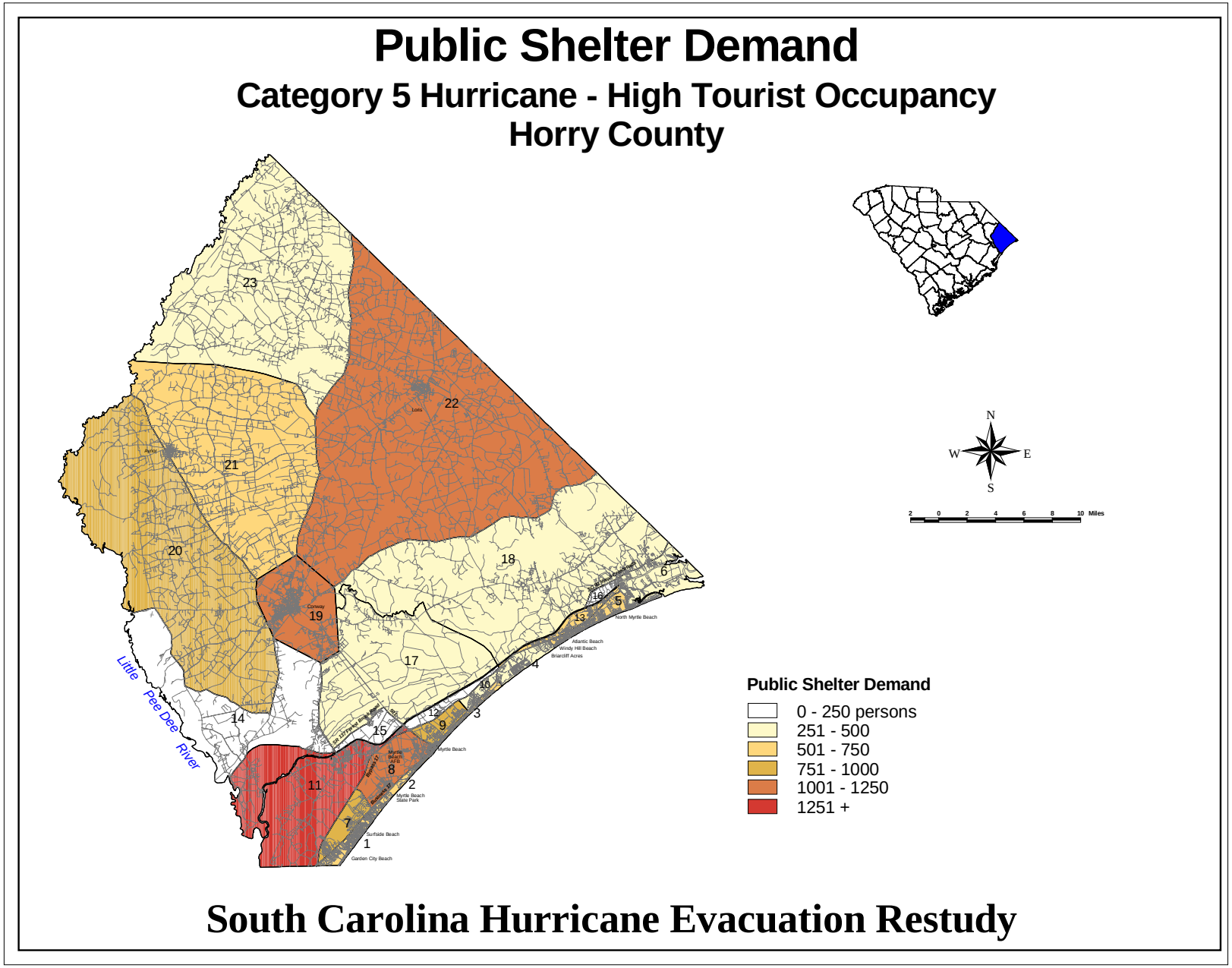


Figure 5-2. Public Shelter Demand Category 5 Hurricane High Tourist Occupancy, Horry County

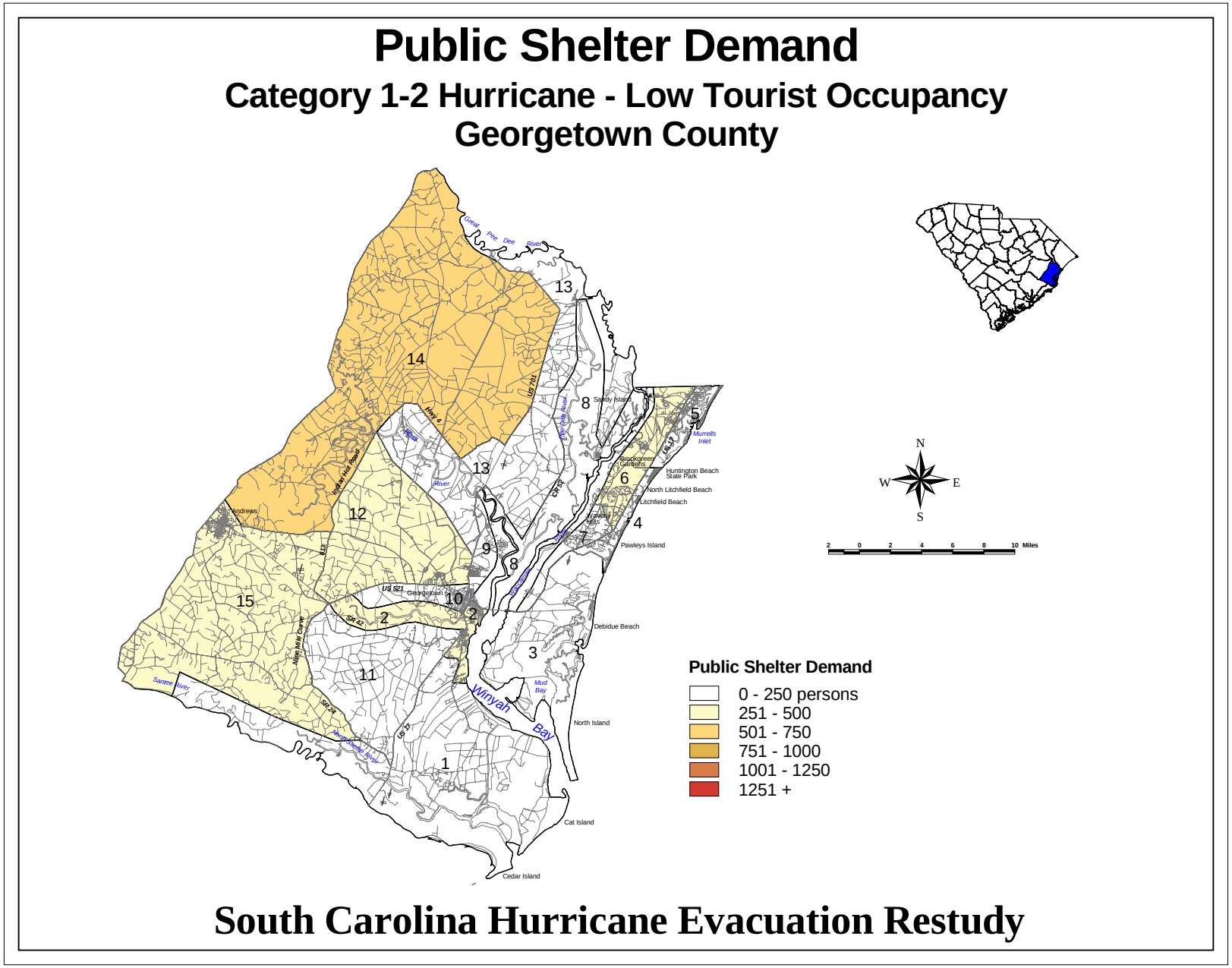


Figure 5-3. Public Shelter Demand Category 1-2 Hurricane Low Tourist Occupancy, Georgetown County

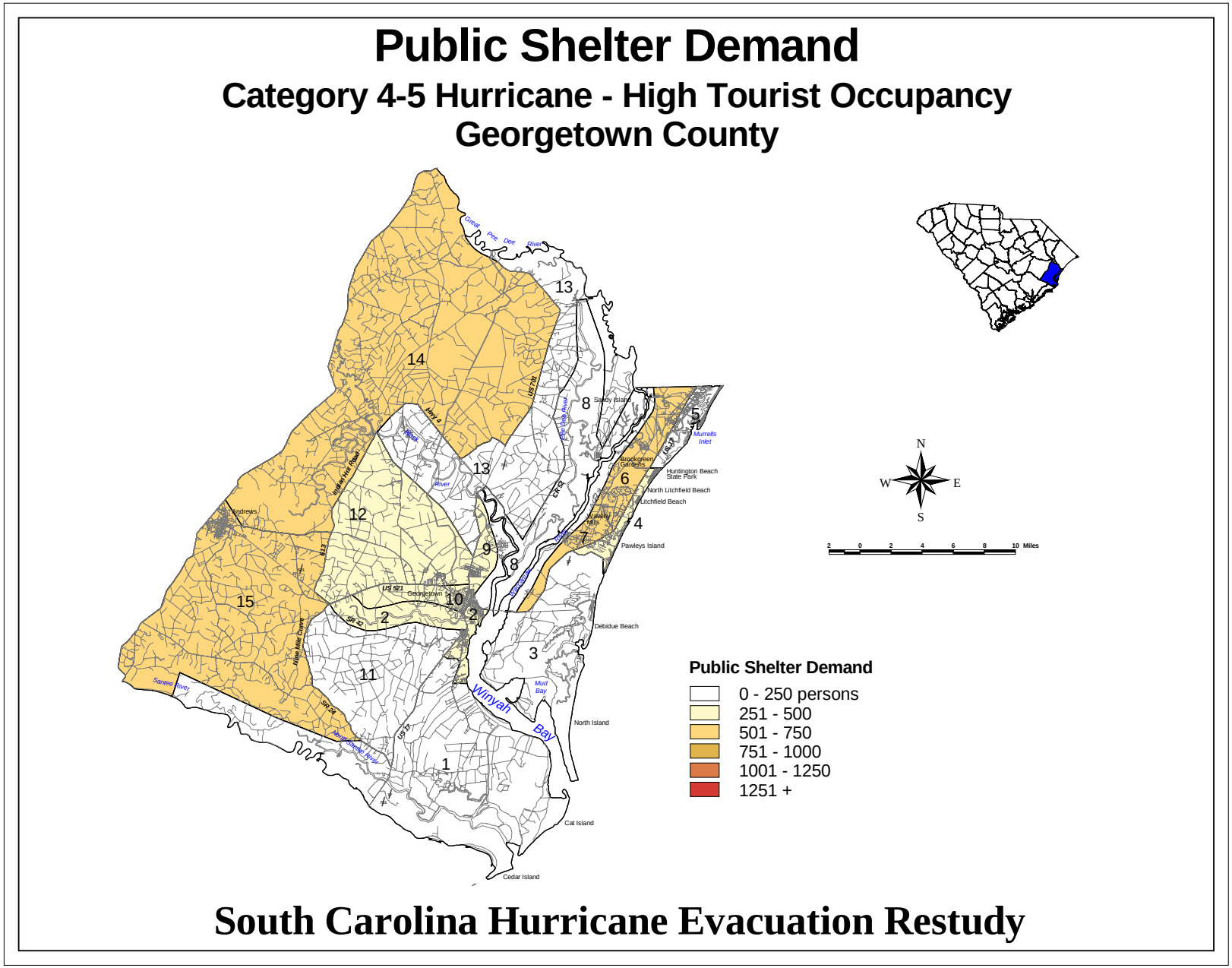


Figure 5-4. Public Shelter Demand Category 4-5 Hurricane High Tourist Occupancy, Georgetown County

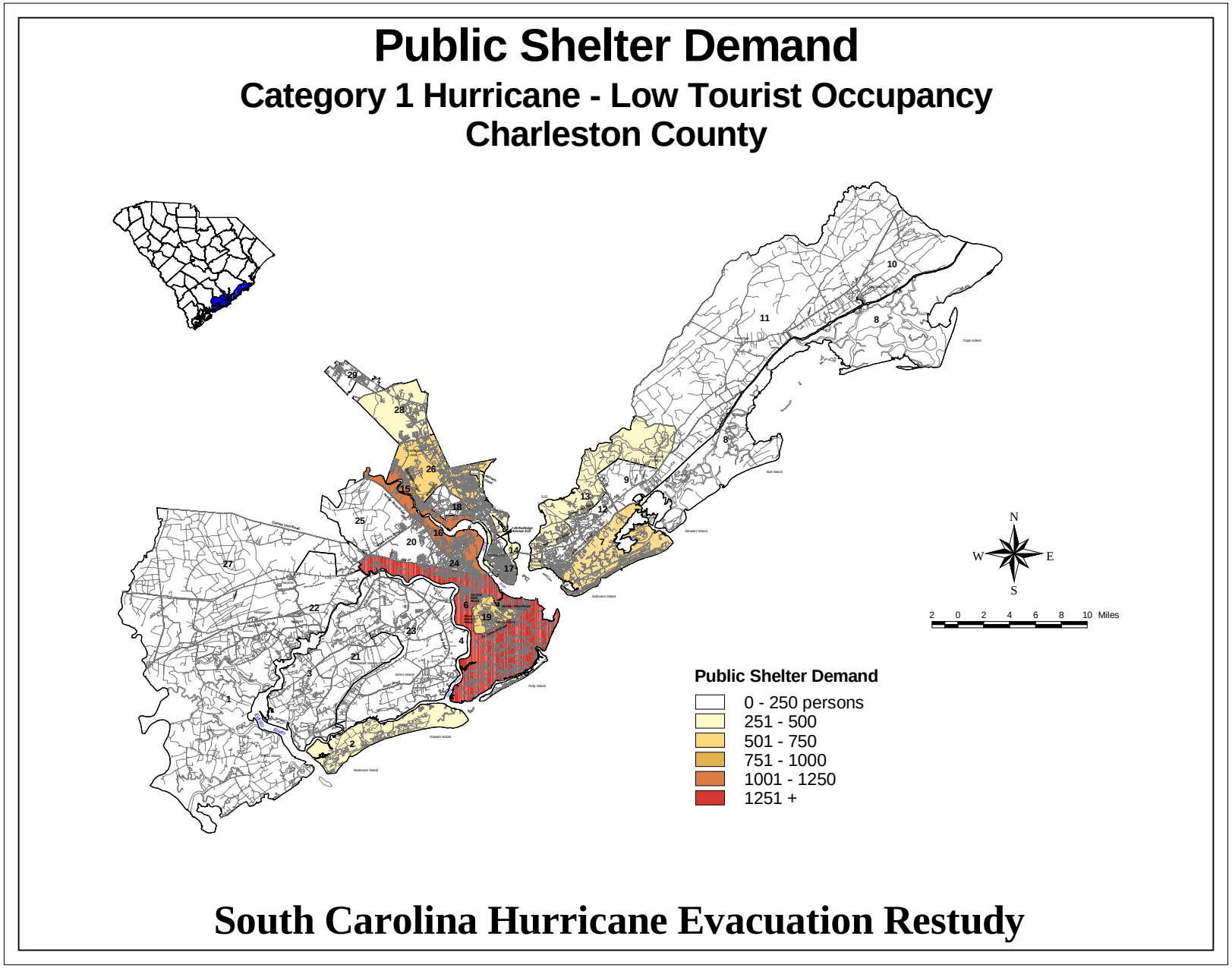


Figure 5-5. Public Shelter Demand Category 1Hurricane Low Tourist Occupancy, Charleston County

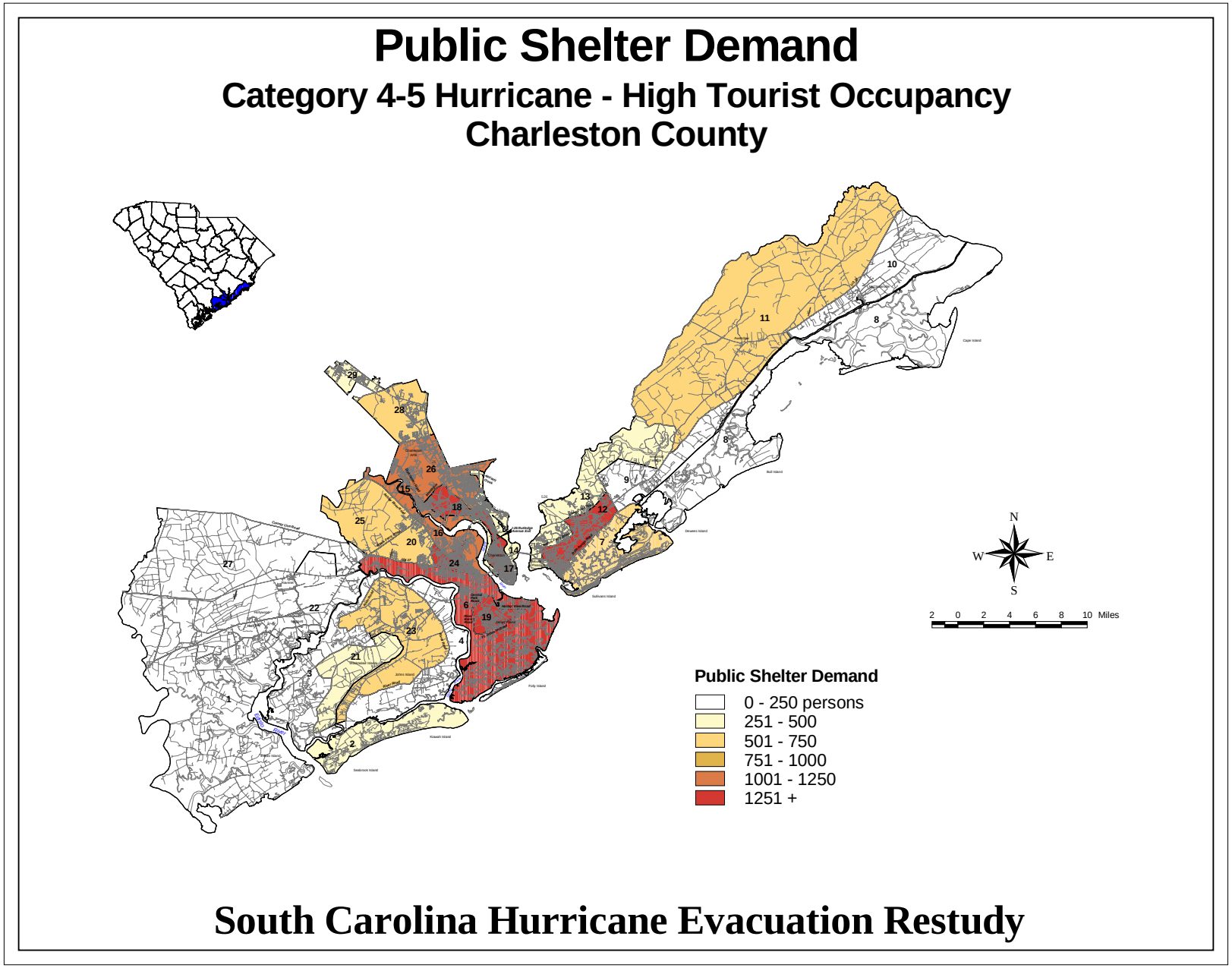


Figure 5-6. Public Shelter Demand Category 4-5 Hurricane High Tourist Occupancy, Charleston County

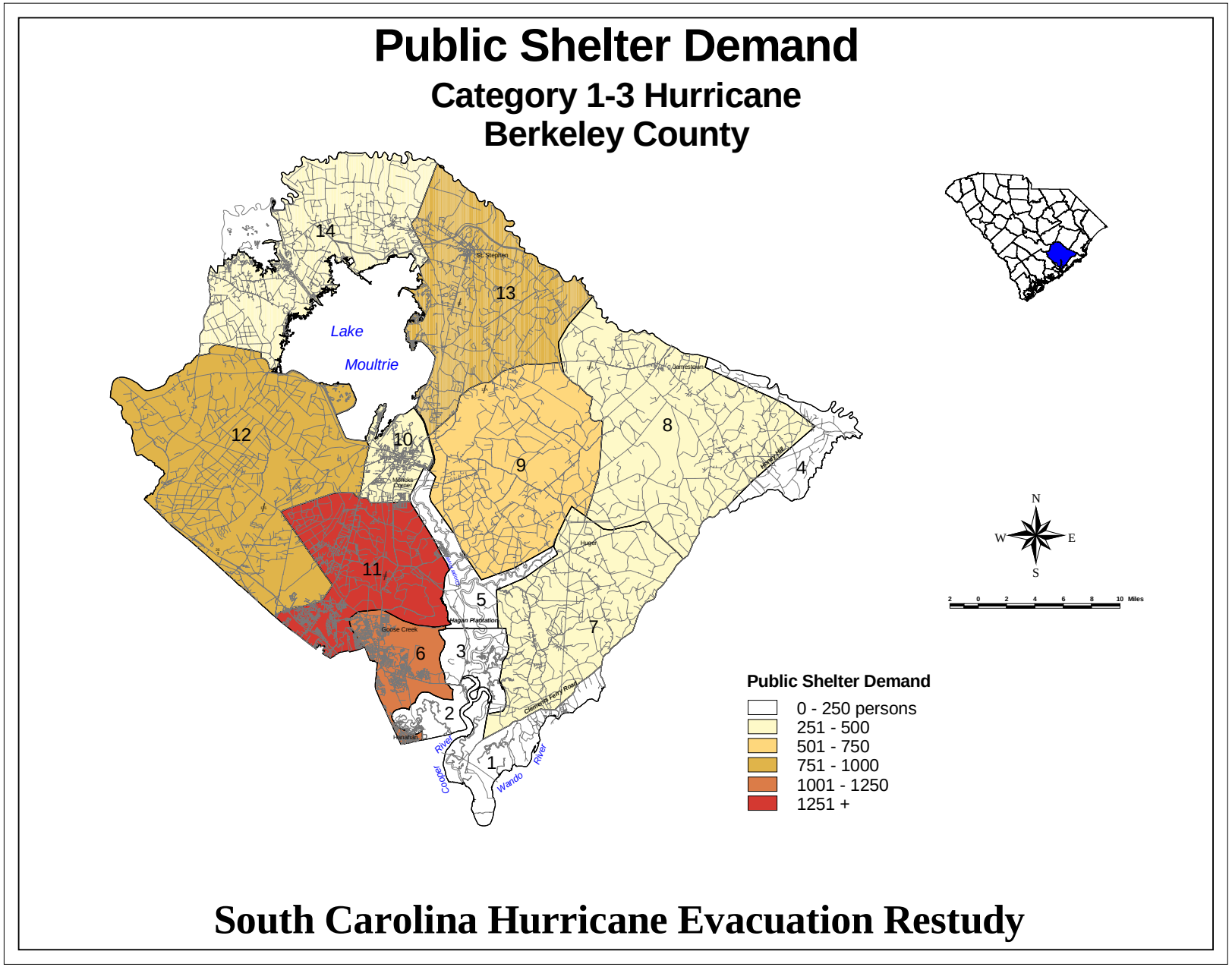


Figure 5-7. Public Shelter Demand Category 1-3 Hurricane, Berkeley County

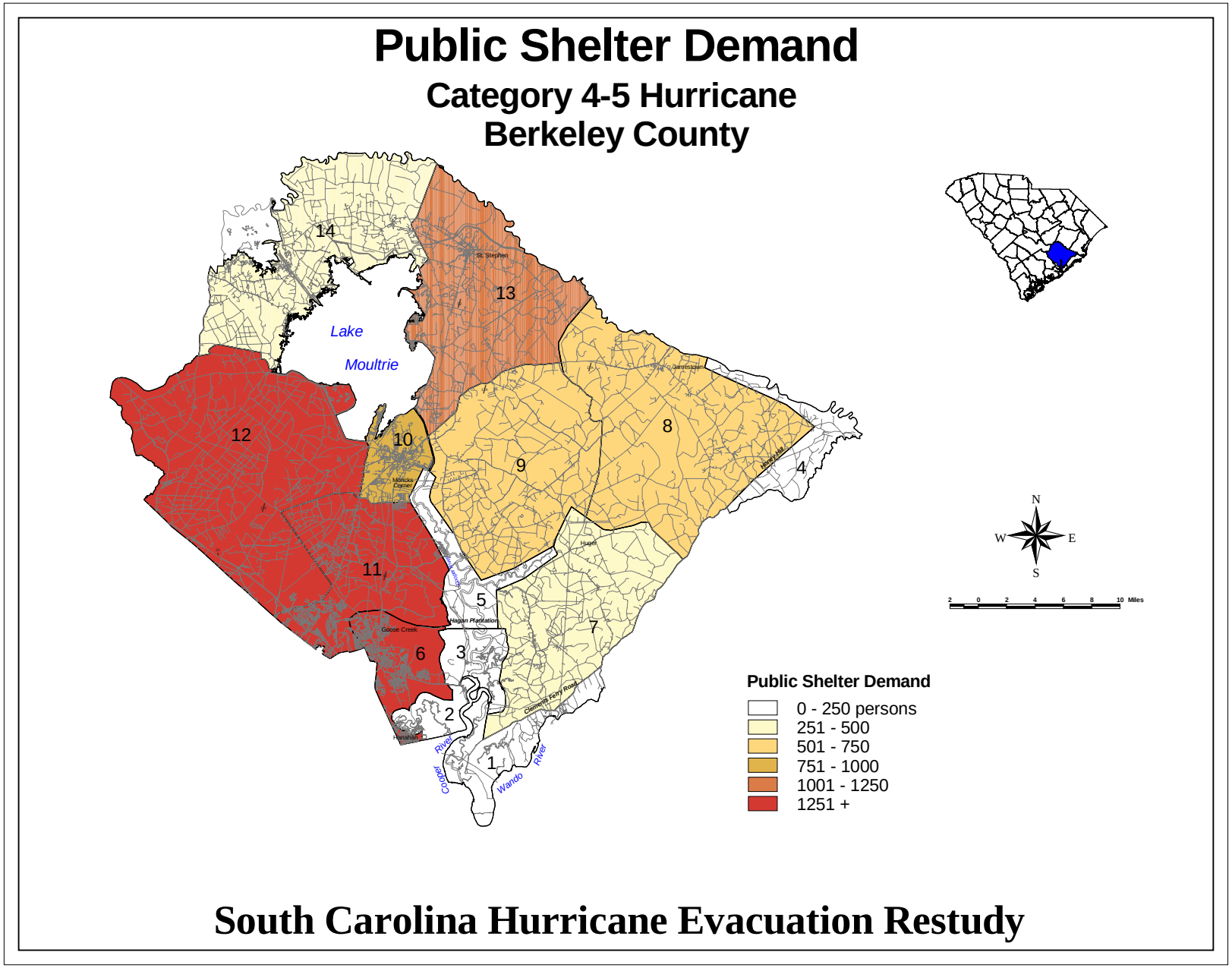


Figure 5-8. Public Shelter Demand Category 4-5 Hurricane, Berkeley County

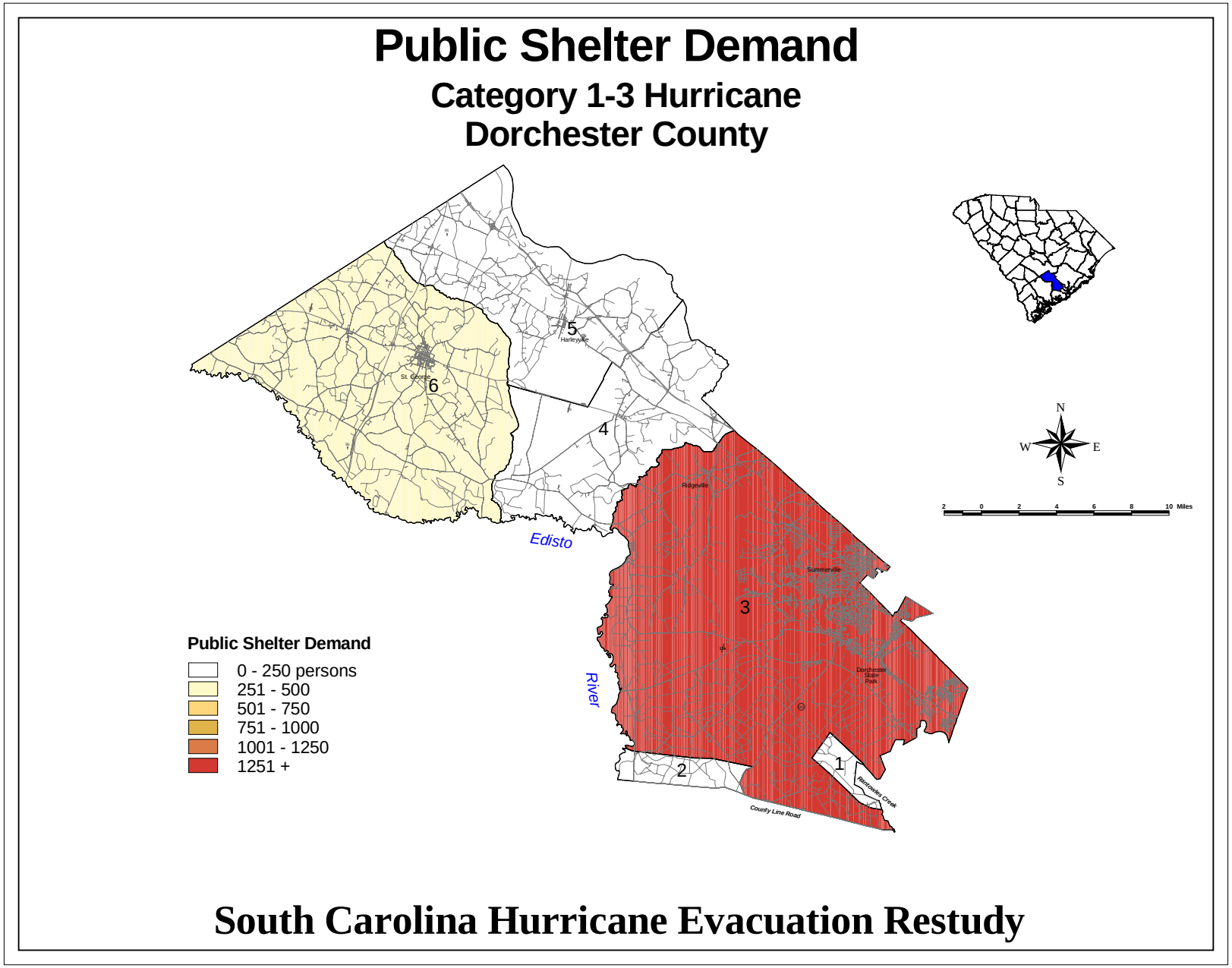


Figure 5-9. Public Shelter Demand Category 1-3 Hurricane, Dorchester County

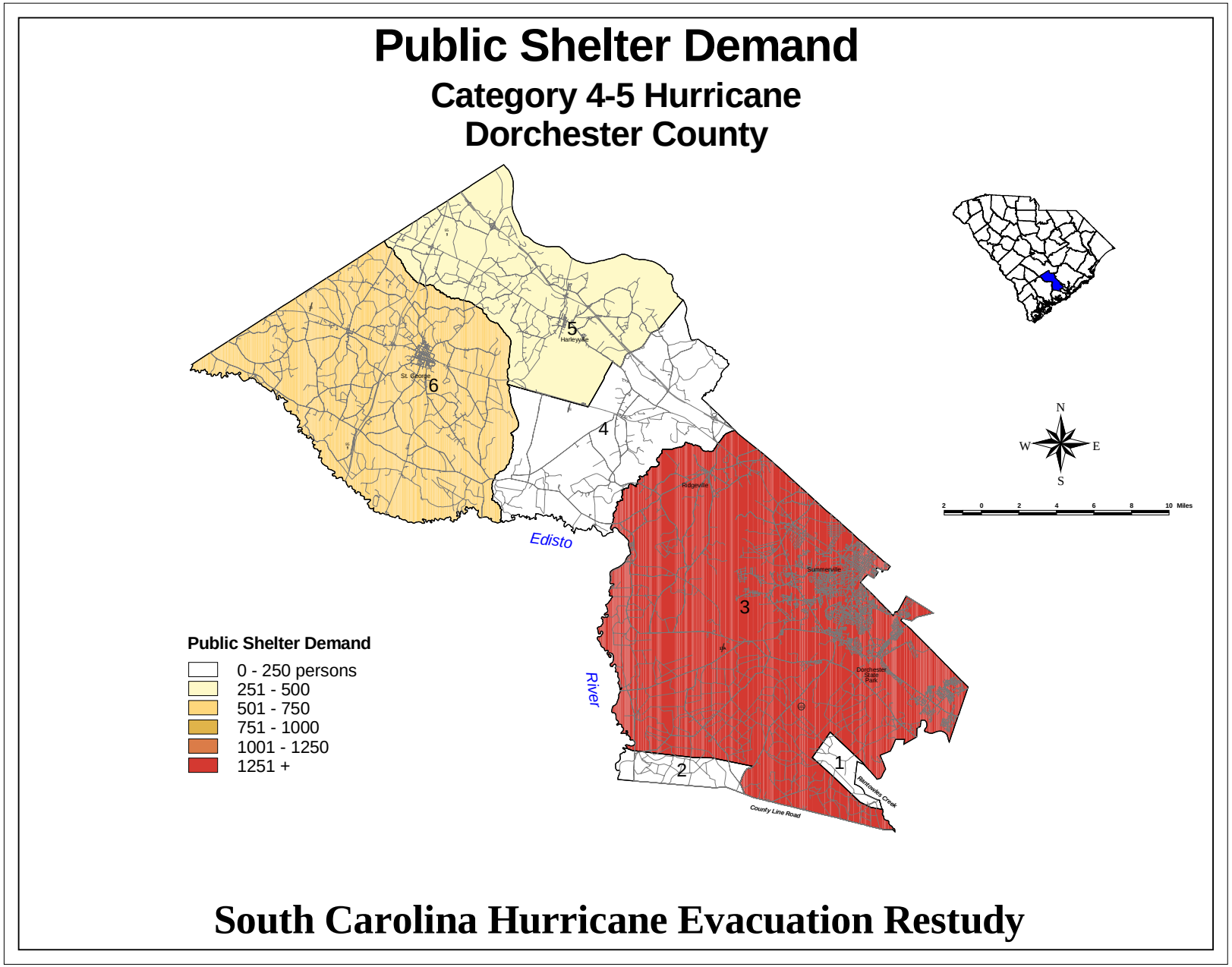


Figure 5-10. Public Shelter Demand Category 4-5 Hurricane, Dorchester County

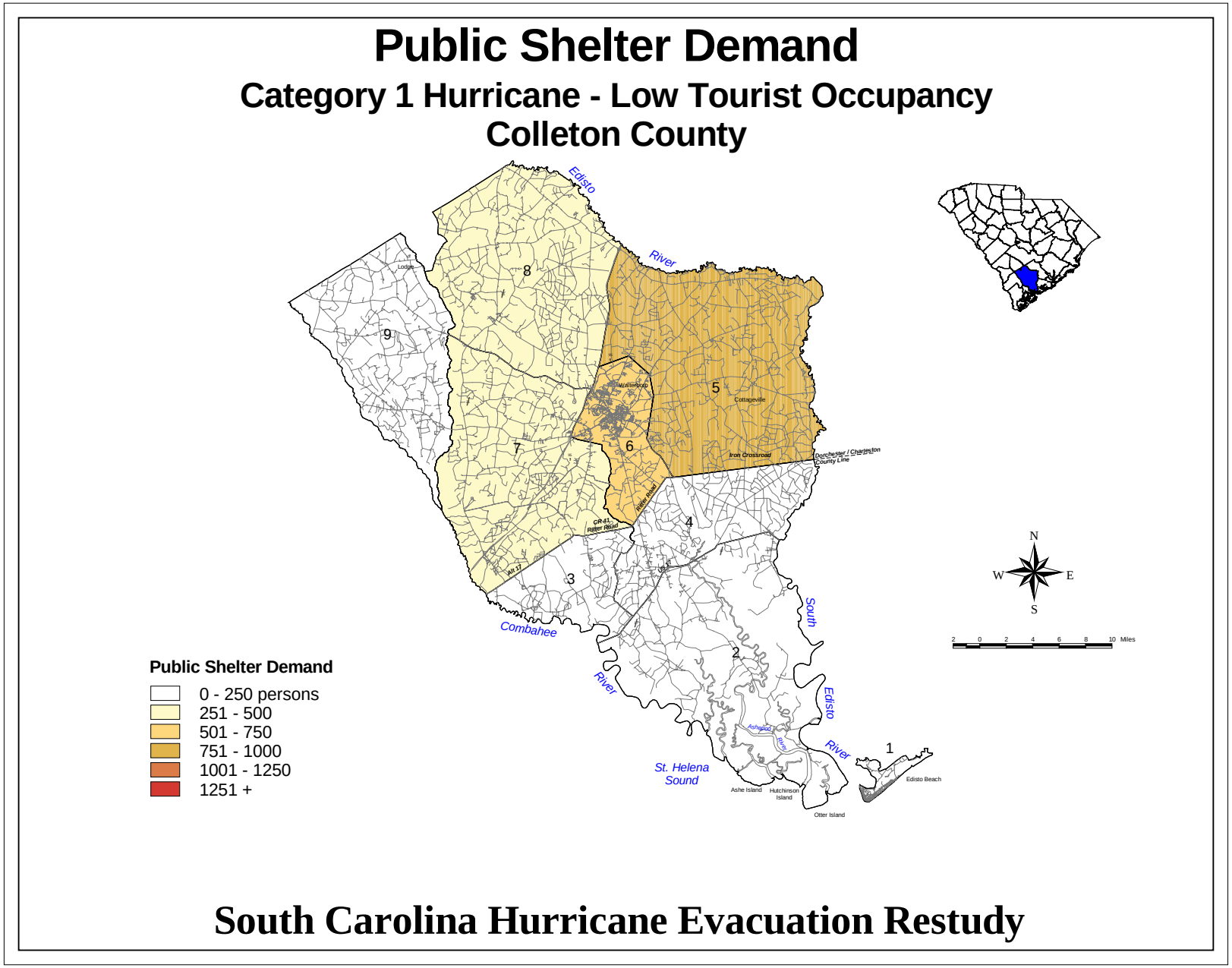


Figure 5-11. Public Shelter Demand Category 1 Hurricane Low Tourist Occupancy, Colleton County

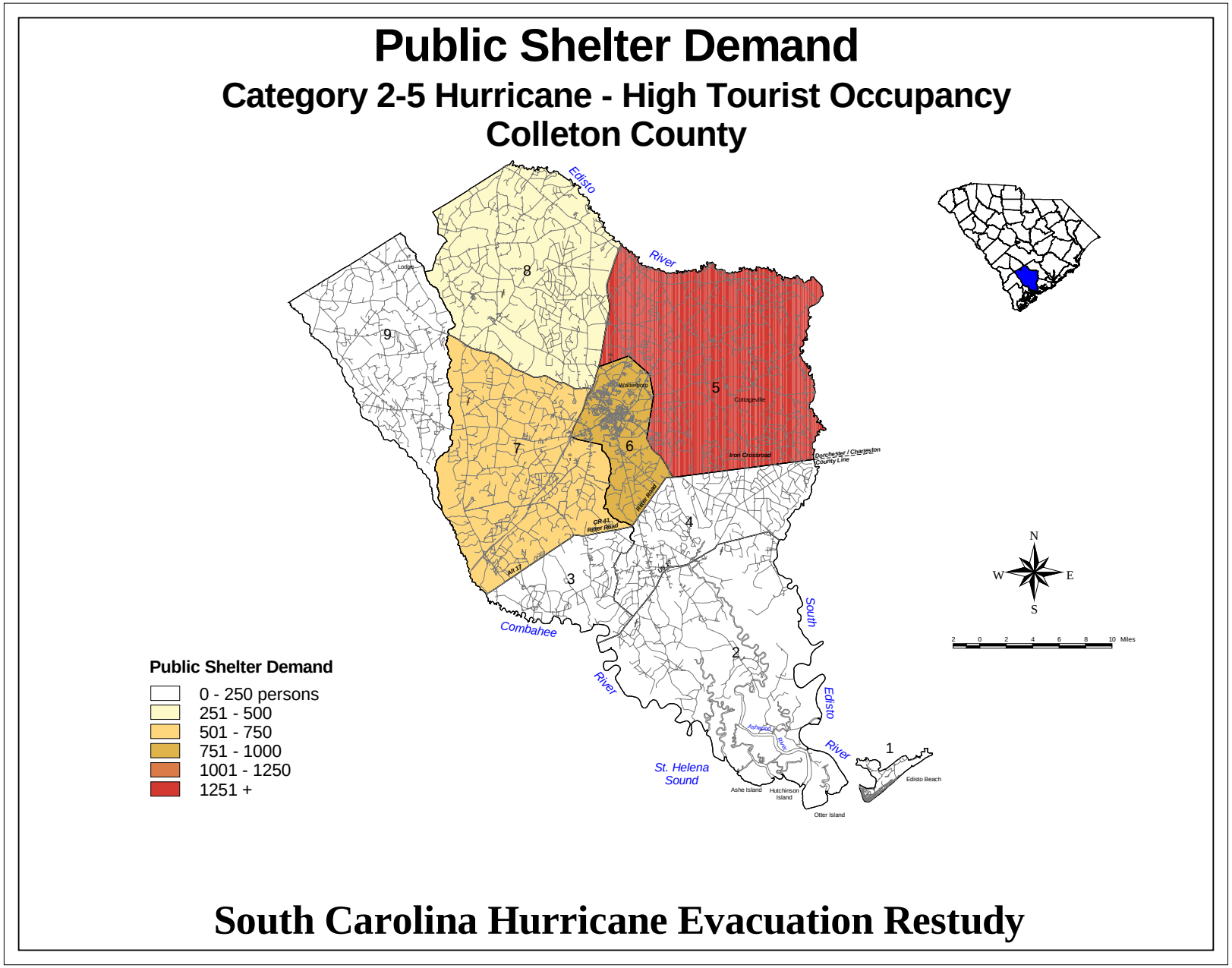
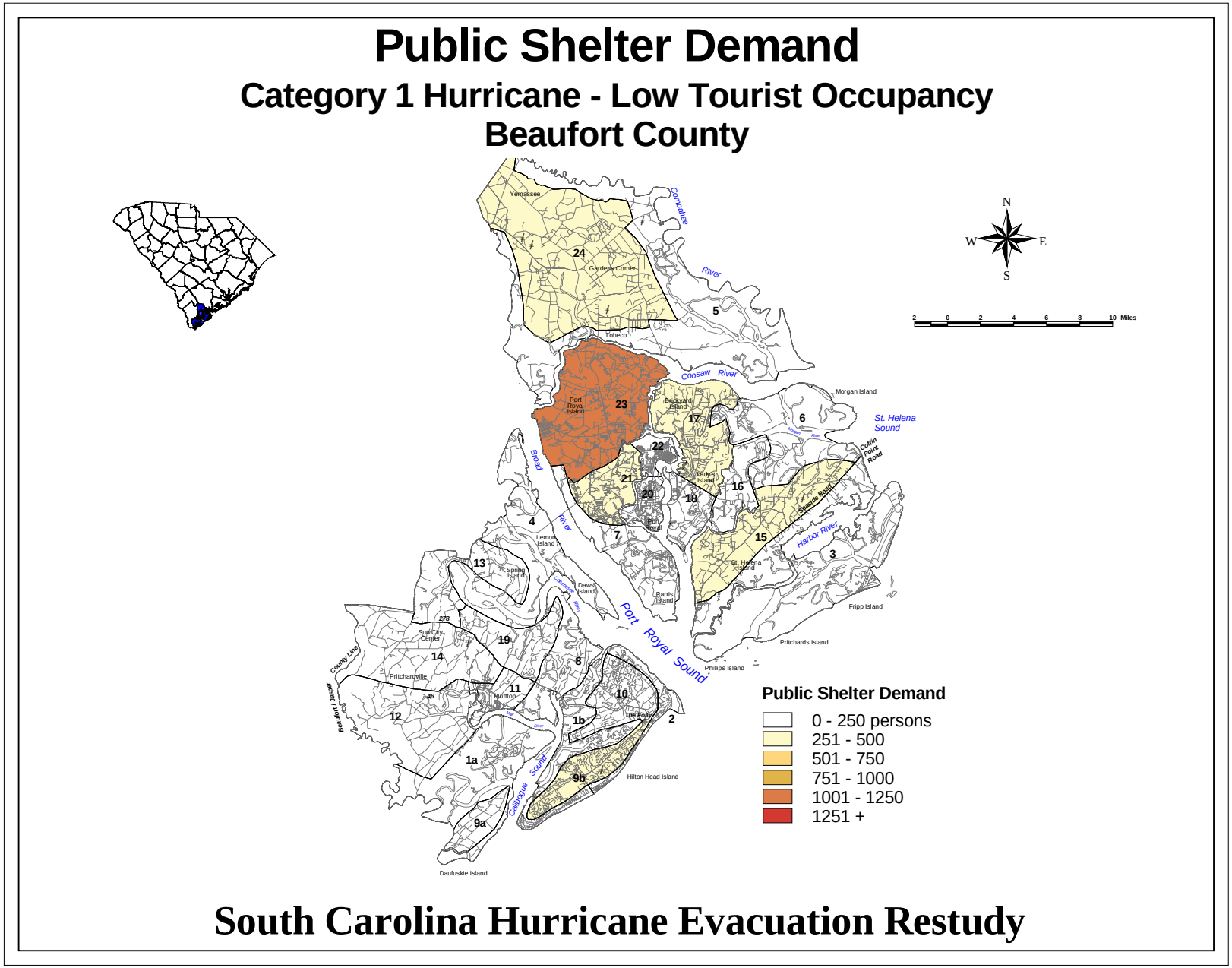
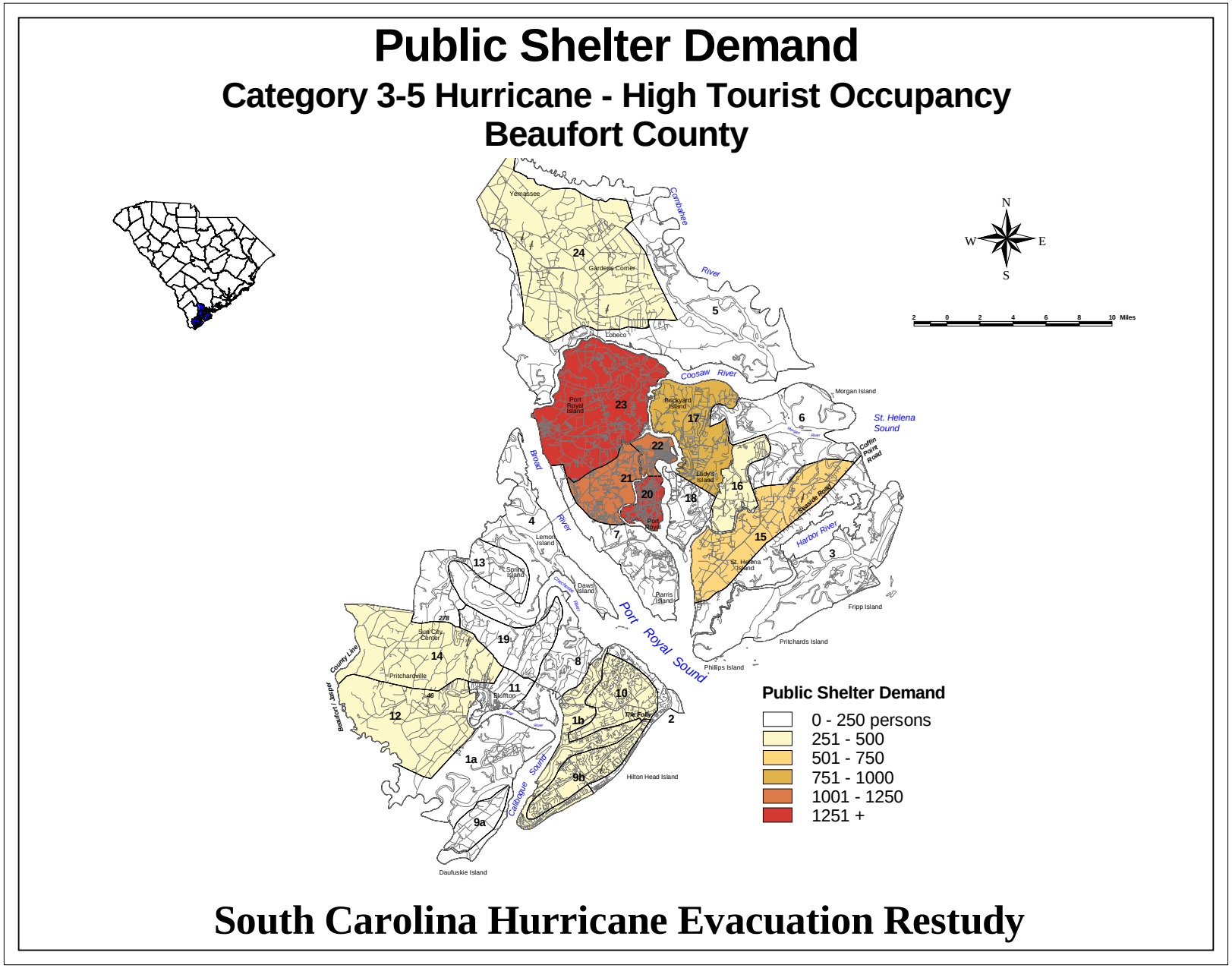


Figure 5-12. Public Shelter Demand Category 2-5 Hurricane High Tourist Occupancy, Colleton County



South Carolina Hurricane Evacuation Restudy

Figure 5-13. Public Shelter Demand Category 1 Hurricane Low Tourist Occupancy, Beaufort County



South Carolina Hurricane Evacuation Restudy

Figure 5-14. Public Shelter Demand Category 3-5 Hurricane High Tourist Occupancy, Beaufort County

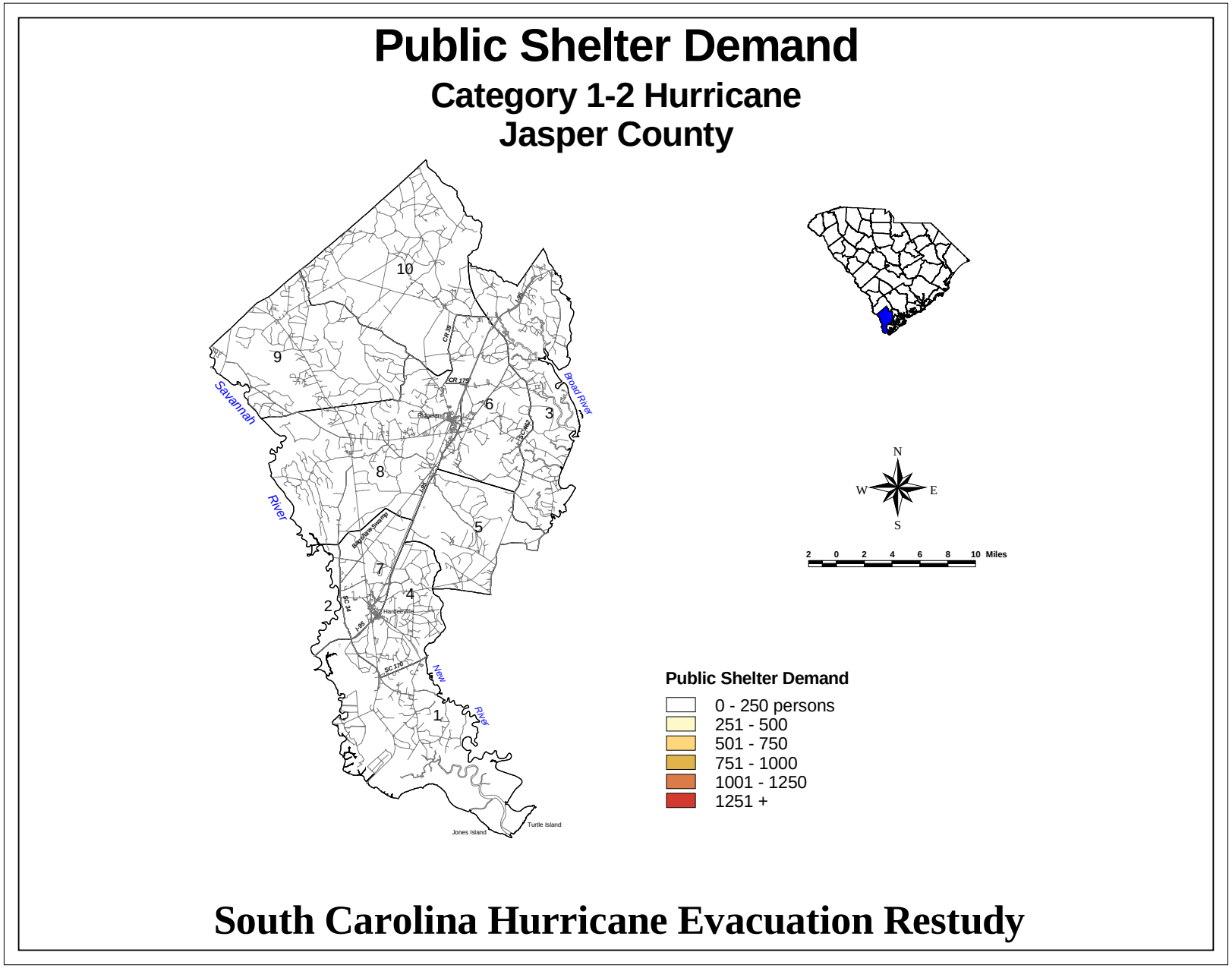


Figure 5-15. Public Shelter Demand Category 1-2 Hurricane, Jasper County

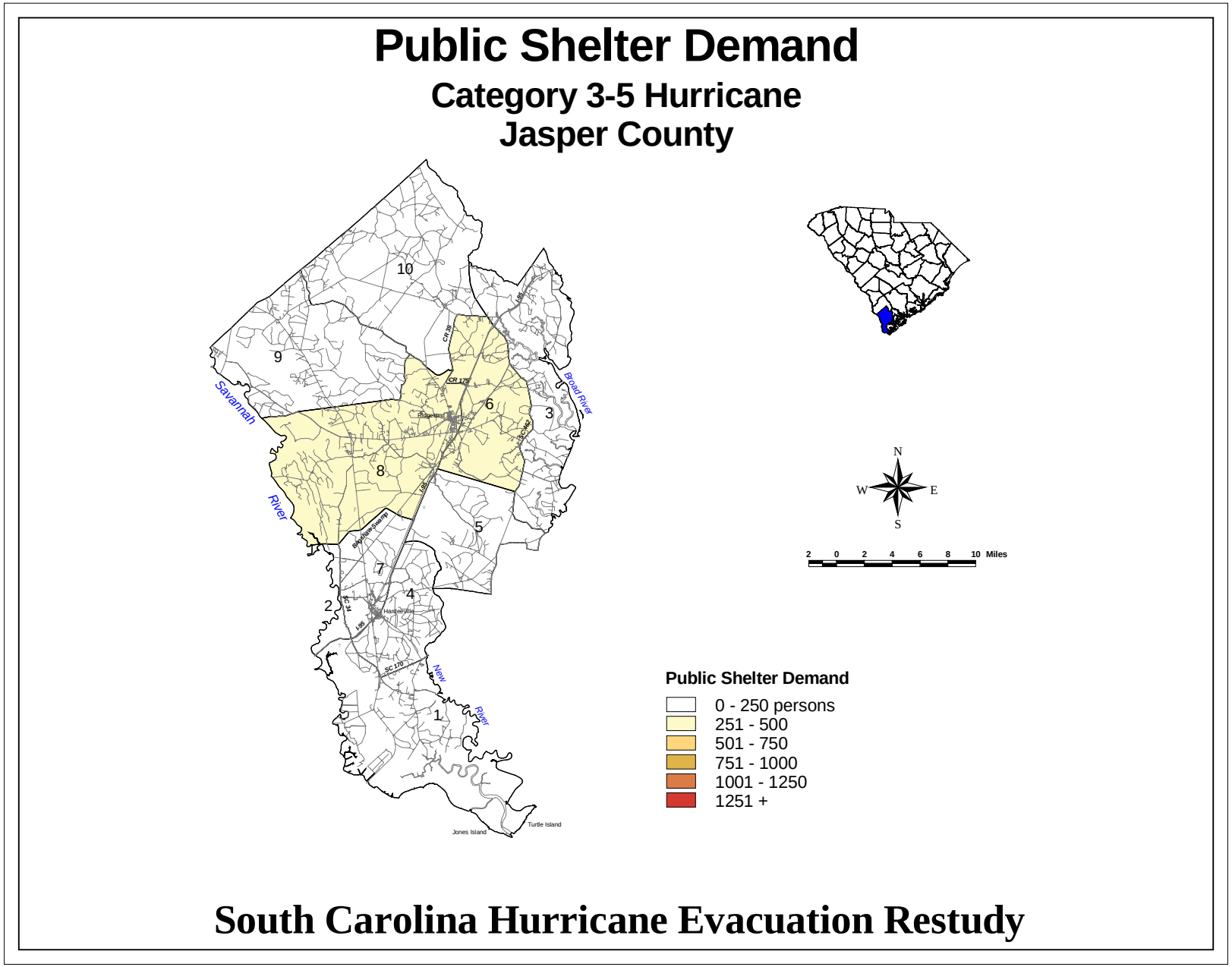


Figure 5-16. Public Shelter Demand Category 3-5 Hurricane, Jasper County

5.2.4 Shelter Vulnerability Analysis

A potential hurricane shelter can be vulnerable to different effects of a hurricane. Storm surge flooding, high winds and freshwater flooding are the main hazards that may render a facility (or its access) unsafe for use as a shelter during a hurricane. This analysis evaluates the inventory of facilities provided to the Corps of Engineers for their vulnerability to storm surge and fresh water flooding. In doing so, the facility's first floor elevation was compared to the predicted storm surge at the building's location for fast moving storms, Categories 1 - 5. A determination was made as to whether or not the facility is located in a Category 1, 2, 3, 4 or 5 storm surge area as well as in the FEMA Special Flood Hazard Area. The Category 4 surge area is of particular interest because the 1992 American Red Cross Guidelines for Hurricane Evacuation Shelter Selection recommends locating hurricane evacuation shelters outside the Category 4 storm surge inundation zones. The guidelines also encourage the avoidance of selecting buildings subject to isolation by surge inundation, or buildings located on barrier islands.

Table 5-3 provides a listing of the inventory of facilities provided to the Corps of Engineers for evaluation for use as potential hurricane evacuation shelters. The determination of whether or not a potential shelter was located in a storm surge area was made by using computer models to query the facility's exact location in relation to the storm surge area. The results of the analysis are displayed in Table 5-4.

As displayed in Table 5-4, the following facilities are located in the Fast Forward Speed Category 4 storm surge and/or may be subject to isolation by a Category 4 storm surge inundation and/or located on a barrier island:

- Baptist Hill High
- Battery Creek High School
- Beaufort Elementary School
- Brentwood Middle
- Frasier Elementary School
- Garret Academy of Tech.
- Georgetown High
- Goodwin Elementary
- Ivenia Brown Elementary
- James Island Middle School
- Jennie Moore Elementary
- C of C Gymnasium
- MUSC Wellness Center
- Michael C Riley Elementary
- Mitchell Elementary School
- Rivers Middle School
- School of Arts
- St. Andrews High School
- St. James-Santee Elementary
- Wando High School
- Norman C. Toole Military
- Moultrie Middle School
- St. Johns High School
- James Island High School
- Citadel #1 Barracks
- Charleston Memorial

Therefore, they do not meet the Red Cross criteria of locating hurricane evacuation shelters. In addition to the above shelters, several shelters were found to be located in a FEMA Special Flood Hazard Area resulting from riverine flood heights and should not be used as hurricane evacuation shelters (See Table 5-4).

TABLE 5-3. Inventory of Facilities for Use as Potential Hurricane Evacuation Shelters

Facility Name	Street Address	City	County	Latitude	Longitude	First Floor Elevation (NAVD)
A.C. Corcoran Elem.	8585 Vistavia Rd.	North Charleston	Charleston	32.96046	-80.0602	39.3
Alice Birney Middle	7750 Pinehurst St.	Charleston	Charleston	32.94189	-80.0571	31.0
Baptist Hill High	5117 Baptist Hill Rd	Hollywood	Charleston	32.72758	-80.261	18.0
Battery Creek High School	1 Blue Dolphin Dr.	Beaufort	Beaufort	32.43301	-80.7453	27.5
Beaufort Elementary School	1800 Prince St.	Beaufort	Beaufort	32.43516	-80.6827	24.8
Beech Hill Elementary School	1001 Beech Hill Rd.	Summerville	Dorchester	32.94943	-80.227	40.7
Brentwood Middle	2685 Leeds Ave.	North Charleston	Charleston	32.85912	-80.0053	16.9
Cainhoy Elementary School	2434 Cainhoy Rd.	Huger	Berkeley	33.02037	-79.853	29.1
Carolina Forest Elementary	285 East Perry Rd.	Myrtle Beach	Horry	33.76195	-78.9551	38.7
CC Blaney Elementary School	7184 Hwy 162	Hollywood	Charleston	32.72804	-80.2887	34.6
Charleston Memorial	Courtenay St.	Charleston	Charleston	32.78220	-79.95119	10.4
Citadel #1 Barracks	Jones Ave.	Charleston	Charleston	32.78499	-79.95204	15.6
C of C Gymnasium	30 George St.	Charleston	Charleston	32.73069	-79.93403	14.4
Coosawhatchie Commun. Ctr.	Hwy 42, West	Coosawhatchie	Jasper	32.58748	-80.9487	42.9
E.A. Burns Elementary	3750 Dorchester Rd.	Charleston	Charleston	32.85372	-79.9917	30.3
E.B. Elllington Elem.	5600 Ellington School Rd.	Ravenel	Charleston	32.77034	-80.2131	33.2
Forestbrook Elementary	4000 Panthers Way	Myrtle Beach	Horry	33.71687	-78.9898	30.3
Fort Dorchester High Schoo	8500 Lincoln Blvd	North Charleston	Dorchester	32.92603	-80.1104	33.7
Frasier Elementary School	63 Columbus St.	Charleston	Charleston	32.79656	-79.9351	13.9
Garret Academy of Tech.	31 Gordon St.	North Charleston	Charleston	32.86185	-80.0023	21.4
Georgetown High	2500 North St.	Georgetown	Georgetown	33.38604	-79.3028	20.5
Givhans Elementary School	273 Hwy 61	Ridgeville	Charleston	32.96555	-80.2946	19.3
Goodwin Elementary	5501 Dorchester Rd.	North Charleston	Charleston	32.86026	-80.0481	13.8
Goose Creek High School	1137 Redbank Rd.	Goose Creek	Charleston	32.97313	-80.0162	40.3
Hanahan Middle School	5818 Murray Dr.	Hanahan	Charleston	32.90775	-79.993	37.8
Hunley Park Elementary	1000 Michigan Ave.	Charleston	Charleston	32.89263	-80.0727	36.2
Ivenia Brown Elementary	Rd. 99 Off Hwy 303 or 17-S	Green Pond	Colleton	32.72639	-80.6058	17.1
James Island High School	1000 Fort Johnson Rd.	Charleston	Charleston	32.81607	-79.85971	22.5
James Island Middle School	1484 Camp Rd.	Charleston	Charleston	32.73308	-79.9628	11.2
Jasper County High School	Hwy 278, West	Ridgeland	Jasper	32.48841	-80.9853	67.7
Jennie Moore Elementary	1256 Hamlin Rd.	Mt. Pleasant	Charleston	32.85002	-79.7961	12.9
Jonesville Elementary	Hwy 21, Rte 2, Box 17	Yamassee	Colleton	32.7327	-80.8058	50.2
Ladson Elementary	3321 Ladson Rd	Ladson	Charleston	32.98573	-80.1059	44.5
Lambs Elementary	6800 Dorchester Rd.	North Charleston	Charleston	32.8858	-80.0646	26.8
Marrington Elementary School	101 Gearing St.	Goose Creek	Berkeley	32.96764	-79.9767	38.3
Matilda F. Dunston Elemtary	1825 Remount Rd.	North Charleston	Charleston	32.89967	-80.0091	48.9
Michael C Riley Elementary	200 Burnt Church Rd.	Beaufort	Beaufort	32.2324	-80.8569	22.1
Midland Park Elementary	2415 Midland Park Rd.	Charleston Heights	Charleston	32.92063	-80.0416	43.9
Minnie Hughes Elemtary	8548 Willtown Rd.	Hollywood	Charleston	32.70034	-80.3736	40.1
Mitchell Elementary School	2 Perry St	Charleston	Charleston	32.79442	-79.9482	11.2
Morningside Middle	1999 Singley Ln	North Charleston	Charleston	32.8775	-80.0021	26.2
Moultrie Middle School	645 Coleman Blvd	Mt. Pleasant	Charleston	32.79039	-79.8721	22.1
MUSC Wellness Center	45 Courtenay Dr.	Charleston	Charleston	32.78485	-79.93384	16.2
Norman C. Toole Military	2950 Carner Ave.	North Charleston	Charleston	32.84987	-79.9684	21.5
North Charleston Elemtary	4921 Durant Ave.	North Charleston	Charleston	32.88443	-79.9822	31.7
North Charleston High	1087 Montague Ave.	North Charleston	Charleston	32.88138	-79.9785	29.8
North Myrtle Beach High	3750 Sea Mountain Hwy	North Myrtle Beach	Horry	33.86358	-78.6679	40.1
Oakbrook Elementary School	4700 Old Fort Rd	Ladson	Dorchester	32.96063	-80.1377	52.0
Oakbrook Middle School	4700 Old Fort Rd.	Ladson	Dorchester	32.96063	-80.1377	55.7
Pepperhill Elementary	3300 Creola Rd.	North Charleston	Charleston	32.93746	-80.0761	26.0
R.D. Schroder Middle School	7224 Hwy 162	Hollywood	Charleston	32.72804	-80.2887	34.6
Ridgeland Elementary School	Bees Creek Hwy	Ridgeland	Jasper	32.48443	-80.9567	53.5
Ridgeland Middle School	Hwy 278, West	Ridgeland	Jasper	32.48443	-80.9567	53.6
Rivers Middle School	1002 Kings St.	Charleston	Charleston	32.80312	-79.9509	14.3
Ron E. McNair Elementary	3795 Spruill Ave.	North Charleston	Charleston	32.8639	-79.9796	30.6
School of Arts	1600 Sarnac St.	North Charleston	Charleston	32.8867	-79.9975	19.3
Socastee Elementary School	4950 Socastee Blvd	Myrtle Beach	Horry	33.68324	-79.0001	17.1
Socastee High School	4950 Socastee Blvd	Myrtle Beach	Horry	33.68416	-78.9969	14.7
St. Andrews High School	721 Wappoo Rd.	Charleston	Charleston	32.79076	-80.0206	20.7
St. James Middle School	9775 St. James Rd.	Surfside Beach	Horry	33.62204	-79.0362	21.8
St. James-Santee Elementary	8900 Hwy 17, North	McClellanville	Charleston	33.06145	-79.5385	16.4
St. Johns High School	1518 Main Rd	Johns Island	Charleston	32.7257	-80.0989	24.8
Stall High School	7749 Pinehurst St.	Charleston Heights	Charleston	32.94189	-80.0571	33.2
Stratford High School	951 Crowfield Blvd	Goose Creek	Charleston	33.01511	-80.0849	47.2
Wando High School	1560 Mathis Ferry Rd.	Mt. Pleasant	Charleston	32.82503	-79.8471	17.5
Windsor Hill Elementary	8600 William Moultrie Dr.	North Charleston	Dorchester	32.93542	-80.1006	21.9

Note: Surveyed elevations were provided by SCEPD. The elevations were acquired by SCEPD from the South Carolina Geodetic Survey. The elevations were provided in North American Vertical Datum 1988 (NAVD).

TABLE 5-4. Potential Of Shelters Being Vulnerable To Hurricane Storm Surge and Located In The FEMA Special Flood Hazard Area.

Shelter Name	County	Located In FEMA Special Flood Hazard Area	Minimum Storm Category In Which Shelters Are Vulnerable To Surge (Normal Speed)	Minimum Storm Category In Which Shelters Are Vulnerable To Surge (Fast Speed)
A.C. Corcoran Elem.	Charleston	NO	0	0
Alice Birney Middle	Charleston	NO	0	0
Baptist Hill High	Charleston	NO	4	3
Battery Creek High School	Beaufort	NO	4	4
Beaufort Elementary School	Beaufort	NO	5	4
Beech Hill Elementary Schol	Dorchester	NO	0	0
Brentwood Middle	Charleston	NO	3	2
Cainhoy Elementary School	Berkeley	NO	0	0
Carolina Forest Elementary	Horry	NO	0	0
CC Blaney Elementary School	Charleston	NO	0	0
Charleston Memorial	Charleston	YES	1	1
Citadel #1 Barracks	Charleston	NO	3	2
C of C Gymnasium	Charleston	NO	2	2
Coosawhatchie Commun. Ctr.	Jasper	NO	0	0
E.A. Burns Elementary	Charleston	NO	0	0
E.B. Elllington Elem.	Charleston	NO	0	0
Forestbrook Elementary	Horry	NO	0	0
Fort Dorchester High School	Dorchester	NO	0	0
Frasier Elementary School	Charleston	NO	3	2
Garret Academy of Tech.	Charleston	NO	5	4
Georgetown High	Georgetown	NO	4	3
Givhans Elementary School	Charleston	YES	0	0
Goodwin Elementary	Charleston	NO	2	2
Goose Creek High School	Charleston	NO	0	0
Hanahan Middle School	Charleston	NO	0	0
Hunley Park Elementary	Charleston	NO	0	0
Ivenia Brown Elementary	Colleton	NO	3	4
James Island High School	Charleston	NO	3	3
James Island Middle School	Charleston	YES	2	2
Jasper County High School	Jasper	NO	0	0
Jennie Moore Elementary	Charleston	YES	3	2
Jonesville Elementary	Colleton	NO	0	0
Ladson Elementary	Charleston	NO	0	0
Lambs Elementary	Charleston	NO	0	0
Marrington Elementary School	Berkeley	NO	0	0
Matilda F. Dunston Elem.	Charleston	NO	0	0
Michael C Riley Elementary	Beaufort	NO	5	3
Midland Park Elementary	Charleston	NO	0	0
Minnie Hughes Elem.	Charleston	NO	0	0
Mitchell Elementary School	Charleston	YES	2	2
Morningside Middle	Charleston	NO	0	0
Moultrie Middle School	Charleston	NO	0	5

Shelter Name	County	Located In FEMA Special Flood Hazard Area	Minimum Storm Category In Which Shelters Are Vulnerable To Surge (Normal Speed)	Minimum Storm Category In Which Shelters Are Vulnerable To Surge (Fast Speed)
MUSC Wellness Center	Charleston	YES	1	1
Norman C. Toole Military	Charleston	NO	5	5
North Charleston Elem.	Charleston	NO	0	0
North Charleston High	Charleston	NO	0	0
North Myrtle Beach High	Horry	NO	0	0
Oakbrook Elementary School	Dorchester	NO	0	0
Oakbrook Middle School	Dorchester	NO	0	0
Pepperhill Elementary	Charleston	NO	0	0
R.D. Schroder Middle School	Charleston	NO	0	0
Ridgeland Elementary School	Jasper	NO	0	0
Ridgeland Middle School	Jasper	NO	0	0
Rivers Middle School	Charleston	NO	2	2
Ron E. McNair Elementary	Charleston	NO	0	5
School of Arts	Charleston	NO	4	4
Socastee Elementary School	Horry	NO	0	5
Socastee High School	Horry	NO	0	0
St. Andrews High School	Charleston	NO	5	4
St. James Middle School	Horry	NO	0	5
St. James-Santee Elementary	Charleston	NO	3	3
St. Johns High School	Charleston	NO	0	5
Stall High School	Charleston	NO	0	0
Stratford High School	Charleston	NO	0	0
Wando High School	Charleston	NO	5	4
Windsor Hill Elementary	Charleston	NO	0	0

“0” Indicates Shelter Is Not In An Area Vulnerable To Storm Surge
“1 – 5” Indicates Storm Surge Category In Which Shelters Are Vulnerable To Surge

TABLE 5-5
Horry County Inventory of Facilities for Use as Potential Hurricane Evacuation Shelters

Facility Name	County	First Floor Elevation (NGVD)
Carolina Forest Elementary	Horry	39.7
Forestbrook Elementary	Horry	31.3
North Myrtle Beach High	Horry	41.2
Socastee Elementary(Middle) School	Horry	18.1
Socastee High School	Horry	15.7
St. James Middle School	Horry	22.8

TABLE 5-6
Georgetown County Inventory of Facilities for Use as Potential Hurricane Evacuation Shelters

Facility Name	County	First Floor Elevation (NGVD)
Georgetown High School	Georgetown	21.5

TABLE 5-7
Berkeley County Inventory of Facilities for Use as Potential Hurricane Evacuation Shelters

Facility Name	County	First Floor Elevation (NGVD)
Cainhoy Elementary School	Berkeley	30.1
Goose Creek High School	Berkeley	41.3
Hanahan Middle School	Berkeley	38.8
Marrington Elementary School	Berkeley	39.3
Stratford High School	Berkeley	48.2

TABLE 5-8
Charleston County Inventory of Facilities for Use as Potential Hurricane Evacuation Shelters

Facility Name	County	First Floor Elevation (NGVD)
CC Blaney Elementary School	Charleston	35.6
Frasier Elementary School	Charleston	14.9
James Island Middle School	Charleston	12.2
Jennie Moore Elementary	Charleston	13.9
Mitchell Elementary School	Charleston	12.2
Moultrie Middle School	Charleston	23.1
R.D. Schroder Middle School	Charleston	35.6
Rivers Middle School	Charleston	15.3
Ron E. McNair Elementary	Charleston	31.6
St. Andrews High School	Charleston	21.7
St. James-Santee Elementary	Charleston	17.4
St. Johns High School	Charleston	25.8
Stall High School	Charleston	34.2
Wando High School	Charleston	18.5
Alice Birney Middle	Charleston	32.0
Baptist Hill High School	Charleston	19.0
Brentwood Middle School	Charleston	17.9
E.A. Burns Elementary	Charleston	31.3
A. C. Cocoran Elementary	Charleston	40.3
E. B. Elington Elementary	Charleston	34.2
Garrett Academy of Tech.	Charleston	22.4

TABLE 5-9
Dorchester County Inventory of Facilities for Use as Potential Hurricane Evacuation Shelters

Facility Name	County	First Floor Elevation (NGVD)
Beech Hill Elementary School	Dorchester	41.7
Fort Dorchester High School	Dorchester	34.7
Givhans Elementary School	Dorchester	20.3
Oakbrook Elementary School	Dorchester	53.0
Oakbrook Middle School	Dorchester	56.7
Windsor Hill Elementary	Dorchester	22.9

TABLE 5-10
Colleton County Inventory of Facilities for Use as Potential Hurricane Evacuation Shelters

Facility Name	County	First Floor Elevation (NGVD)
Ivenia Brown Elementary	Colleton	18.0
Jonesville Elementary	Colleton	51.1

TABLE 5-11
Beaufort County Inventory of Facilities for Use as Potential Hurricane Evacuation Shelters

Facility Name	County	First Floor Elevation (NGVD)
Battery Creek High School	Beaufort	28.4
Beaufort Elementary School	Beaufort	25.7
Michael C Riley Elementary	Beaufort	23.0

TABLE 5-12
Jasper County Inventory of Facilities for Use as Potential Hurricane Evacuation Shelters

Facility Name	County	First Floor Elevation (NGVD)
Coosawhatchie Community Ctr.	Jasper	43.8
Jasper County High School	Jasper	68.6
Ridgeland Elementary School	Jasper	54.4
Ridgeland Middle School	Jasper	54.5

5.2.5 Summary

Of the 66 facilities evaluated, 40.9 percent are located in the Category 4 fast forward moving storm surge, surrounded by a Category 4 fast forward moving storm surge, or located in a FEMA special flood hazard area. Based on the best available data, these 27 facilities do not meet the 1992 American Red Cross "Guidelines for Hurricane Evacuation Shelter Selection," which recommends locating hurricane evacuation shelters outside of the Category 4 storm surge inundation areas and not inside the Special Flood Hazard Area (100-yr flood zone).

Baptist Hill High School
Beaufort Elementary School
Frasier Elementary School
Georgetown High School
Goodwin Elementary School
James Island Middle School
Michael C. Riley Elementary School
Moultrie Middle School
School of Arts
St. James-Santee Elementary School
Wando High School
James Island High School
Citadel #1 Barracks
Charleston Memorial Hospital
Battery Creek High School
BrentWood Middle School
Garret Academy of Technology
Givhans Elementary School
Ivenia Brown Elementary School
Jennie Moore Elementary School
Mitchell Elementary School
Rivers Middle School
St. Andrews High School
St. Johns High School
Norman C. Toole Military
C of C Gymnasium
MUSC Wellness Center

In Beaufort County 100 percent, or 3 of the 3 facilities evaluated are located within the Category 4 storm surge. In Charleston County 53.8 percent, or 21 of the 39 facilities evaluated are located within the Category 4 storm surge or surrounded by a Category 4 storm surge. In Colleton County 50 percent, or 1 of the 2 facilities evaluated were located within the Category 4 storm surge. In Georgetown County 100 percent, or the 1 facility evaluated was located within the Category 4 storm surge. Based on these findings a significant number of facilities evaluated do not meet the Red Cross criteria.

Of the total facilities evaluated, 59.1 percent or 39 of 66, meet the Red Cross criteria and are located outside of the Category 4 storm surge.

Carolina Forest Elementary
North Myrtle Beach High
Socastee High School
Cainhoy Elementary School
Hanahan Middle School
Strafford High School
R. D. Schroder Middle School
Forest Brook Elementary School
Socastee Elementary (Middle)
St. James Middle School
Goose Creek High School
Marrington Elementary School
C. C. Blaney Elementary School
Ron E. McNair Elementary School

Stall High School
E. A. Burns Elementary
E. B. Elington Elementary
Ladson Elementary
Matilda F. Dunston Elementary
Minnie Hughes Elementary
North Charleston High School
Pepperhill Elementary
Fort Dorchester High School
Oakbrook Middle School
Jonesville Elementary
Jasper County High School
Ridgeland Middle School
Alice Birney Middle School
A. C. Cocoran Elementary
Hunley Park Elementary
Lambs Elementary
Midland Park Elementary
Morningside Middle School
North Charleston Elementary
Beech Hill Elementary School
Oakbrook Elementary School
Windsor Hill Elementary
Coosawhatchie Community Center
Ridgeland Elementary School

These 39 facilities meet the requirements for use as hurricane evacuation shelters in relation to hurricane storm surge hazards. An evaluation of the vulnerability of these facilities to high winds has not been addressed in this analysis.

This up-to-date, accurate technical data should be used by state and local officials to ensure that South Carolina's hurricane vulnerable population can find adequate and safe public shelter.

5.2.6 First Floor Elevations of Potential Shelters

The S.C. Emergency Preparedness Division (SCEPD) and the S.C. Geodetic Survey (SCGS) worked closely together to obtain the First Floor Elevations of the 66 shelters that were analyzed for the 1999 Interim Public Shelter Analysis and this report. The SCEPD collected hurricane evacuation shelter information from local emergency managers in coordination with the S. C. Department of Social Services and the American Red Cross. A precise analysis of a site's elevation and location is required to determine for which storm-surge conditions a shelter will be safe. At this point, the SCGS became involved to survey shelters.

The SCGS determined the elevation and the horizontal geographic coordinates for each shelter by one of two methodologies. The methodology depended on whether or not a benchmark with a published elevation in the National Spatial Reference System was located within a one-mile radius of the shelter.

The SCGS chose to set all elevation stations on the first step at a shelter's entrance. The choice was for consistency and was not a project requirement. The location, however, is that required by the Federal Emergency Management Agency to determine the elevation of a structure for its flood insurance program. An elevation station is a PK nail* secured in the ground to make the station permanent. The SCGS wrote a station

description for each PK nail and drew a sketch showing the location of the nail. A PK nail was the nail of choice because the head of the nail has a slight dimple which is used as a datum point. The datum point can be re-occupied easily if the need ever arises.

Shelter elevations were determined by conventional leveling either from a benchmark or from a new Global Positioning System (GPS) station established on the property. If a bench was located within one mile, a double-run level line was observed from the benchmark to the PK nail at the shelter's entrance. All benchmark elevations had been determined by observing conventional leveling techniques.

The horizontal geographic coordinates, expressed as state plane coordinates, were determined for each shelter using GPS. A mapping – or resource-grade GPS receiver, the TRIMBLE Navigation, Pathfinder Pro XR, was used when an acceptable benchmark was not within a one-mile radius. Data was recorded for 15 minutes at the PK nail at the shelter's entrance. If the shelter's entrance was obstructed such that data was uncollectable, an acceptable point as close to the PK nail as possible was occupied. Data was differentially corrected using data simultaneously collected from the SCGS's Community Base Station at the Department of Natural and Marine Resources Center on James Island in Charleston County.

If the site did not have a benchmark within the required one-mile radius, the elevation was determined by double-run conventional levels from a new GPS station established on the property to the PK nail at the shelter's entrance. A survey-grade GPS receiver, a TRIMBLE Navigation 4000 SSI L1/L2, was used to record data at a second PK nail set on the property at a point with an unobstructed horizon. A second survey-grade receiver was positioned at a geodetic monument with known horizontal and vertical coordinates to simultaneously record data. Additional data were abstracted from GPS data simultaneously collected at the U. S. Coast Guard's Continuously Operating Reference Station (CORS) on Sullivan's Island in Charleston County. The three data sets were post-processed to determine the horizontal and vertical coordinates of the new GPS station. The elevation for the new GPS station was determined using recently published National Geodetic Survey guidelines for vertical control established by GPS.

Results from both methods to determine elevation met the third order standard the Corps of Engineers specified for hurricane shelters. The accuracy of the horizontal coordinates using the resources-grade GPS receiver is approximately 60 centimeters; whereas, the accuracy is two to three centimeters using the survey-grade receiver. Both provided acceptable accuracy for the horizontal coordinates.

The National Geodetic Survey (NGS) has determined that it is necessary to readjust the national vertical control network. The current reference is the National Geodetic Vertical Datum of 1929 (NGVD 1929). This datum (NGVD 1929) was used to calculate water heights within a SLOSH grid square. Also this datum, (NGVD 1929) was used to create

the storm surge maps. Elevations for each shelter were provided by SCGS referenced to the new national datum, the North American Vertical Datum of 1988 (NAVD 1988). To convert from the new national datum (NAVD 1988) to the current referenced datum (NGVD 1929), published elevations at the same benchmark within the study area were compared. The difference in elevations between the two datums averaged from 0.90 feet in Beaufort County to 1.00 feet in Horry, Georgetown and Charleston Counties with the NGVD 1929 datum being 0.90 feet to 1.00 feet higher than the NAVD 1988 datum. Therefore, an elevation of 25.0 feet referenced to NAVD 1988 in Charleston County would be 26.0 feet referenced to NGVD 1929.

* A PK nail is a masonry nail manufactured by Parker Kalon which is used by surveyors to mark points in asphalt, concrete or similar materials.

A portion of the above description was taken from "Agencies Partner to Keep Citizens Safe" article, SMAC-DABS, Newsletter of the South Carolina State Mapping Advisory Committee.

CHAPTER SIX – TRANSPORTATION ANALYSIS

6.1 INTRODUCTION

With a number of memorable hurricane threats and strikes, including Hurricanes Hugo in 1989, Bertha and Fran in 1996, and Floyd in 1999, the emergency preparedness officials in South Carolina continue to fine tune their preparedness for more active hurricane seasons in the early 21st century. The area faces a significant storm surge inundation potential and is extremely vulnerable to freshwater flooding in low-lying inland areas. Urban population centers in Beaufort, Charleston, Georgetown and Myrtle Beach, as well as many inland cities and towns are susceptible to severe hurricane force winds well before a system decays after landfall. The attraction of the area as a premier tourist destination during hurricane season complicates the hurricane threat and resulting response.

For future hurricane threats, South Carolina faces evacuations of vulnerable population who have gained first-hand evacuation experience and a limited road network that provides westbound roadway capacity for evacuation movements. The difficulties for evacuees will be during peak tourist seasons where inland hotel/motel space is used up and where many out-of-county evacuees try to load the road network in a short period of time. Simultaneous evacuations of the Florida, Georgia and North Carolina coast will make such evacuations even more of a challenge.

During a hurricane evacuation effort for South Carolina, a significant number of vehicles will have to be moved across the local and regional road network. The magnitude of evacuating vehicles will vary depending upon the intensity of the hurricane, publicity and warnings given about the storm, and certain behavioral response characteristics of the vulnerable population. During a typical evacuation, vehicles enter the road network at different times depending on the evacuees' response relative to an evacuation order or storm advisory. Conversely, vehicles leave the road network depending on both the planned destinations of evacuees and the availability of acceptable destinations such as public shelters, hotel/motel units and friend's or relative's homes in non-surge prone areas. Vehicles move across the road network from trip origin to destination at a speed dependent on the rate of traffic loadings on various roadway segments and the ability of the segments to handle a certain volume of vehicles each hour. Estimates of evacuation clearance times for the study area must include the effects of evacuation traffic generated

by neighboring counties and states. For a more detailed account of all transportation analysis activities not addressed in this document, refer to Appendix F- South Carolina Hurricane Evacuation Restudy Transportation Analysis Transportation Model Support Document that is printed separately and available through the Charleston District Corps of Engineers.

6.2 ANALYSIS OBJECTIVES AND SCOPE

Recognizing the importance of updating hurricane evacuation clearance times for South Carolina, the U.S. Army Corps of Engineers, Charleston District, contracted Post, Buckley, Schuh and Jernigan, Inc.(PBS&J) to perform the necessary tasks. The major objectives of the update were as follows:

1. Work with the state and counties to develop traffic evacuation zones and scenarios to be used for transportation modeling and clearance time calculations for each county.

2. Quantify the population and dwelling units in each zone and quantify the potential evacuation population for each scenario.

3. Identify the existing evacuation roadway network noting improvements that have been made since the hurricane evacuation study was completed in the mid 1980's by the U.S. Army Corps of Engineers.

4. Determine the hurricane evacuation clearance times for each county and storm scenario for a projected Year 2000 base year applied to the primary evacuation routes designated by the SCDOT for the 1999 hurricane season. (A future year 2005 scenario was also specified in the original scope but population/dwelling unit forecasts were largely unavailable for the Year 2005)

5. Determine and document regional evacuation traffic that is expected to cross county and state lines so that more meaningful operational planning can take place.

6. Identify local and regional bottlenecks/critical roadway segments and where applicable, recommend general traffic control strategies.

7. Develop zone and road network graphics in an ESRI ArcInfo/ArcView usable format.

8. Using the zone graphic for each county, develop GIS graphics displaying:
    - Permanent occupied dwelling units by evacuation zone
    - Mobile home units by evacuation zone

- Seasonal dwelling units by evacuation zone
- Evacuating people by evacuation zone by scenario
- Public shelter demand by evacuation zone by scenario

9. Using the evacuation road network graphic for each county, develop GIS graphics displaying:
   - Directional service volume per roadway segment
   - Evacuation traffic congestion by roadway segment by scenario

10. Deliver GIS digital files and graphics to the state, Corps and counties, as requested.

11. Develop a simplistic abbreviated "model" in a spreadsheet format that can be used by the state, to modify clearance times based on land use and system changes.

6.3 COORDINATION AND REVIEW ACTIVITIES

A critical element in performing the study tasks was the coordination with the staff of each county, the State of South Carolina and the U.S. Army Corps of Engineers, Charleston District. Meetings began in December of 1997 to coordinate the various technical inputs to the analysis and to review graphics and evacuation statistics developed in the study. The state and counties were provided with draft data throughout the process so that final results would be more credible and usable. The state and several counties have invested considerable time to develop the permanent and tourist related dwelling unit database used for this analysis. Extensive coordination efforts took place in the summer of 1999 to develop evacuation zone systems acceptable to the state and counties, describable to the public, and responsive to newly revised SLOSH mapping that came available in the spring of 1999.

6.4 EVACUATION TRAVEL PATTERNS

The movements associated with hurricane evacuation have been identified for the purposes of this analysis by five general patterns as follows:

A. **In-County Origins to In-County Destinations**. Trips made from primarily storm surge vulnerable areas and mobile home units in an individual county to destinations within the <u>same</u> county, such as public shelters, hotel and motel units, churches, and friends or relatives outside the storm surge vulnerable areas.

B. **In-County Origins to Out-of-County Destinations**. Trips made that originate in an individual county but have destinations in <u>other</u> counties of the study area or <u>outside</u>

the study area entirely. This is a significant category for the South Carolina Region as many coastal evacuees seek safe destinations.

C. **Out-of-County Origins to In-County Destinations**. Trips made as in category A that enter an individual county from other counties in the study area.

D. **Out-of-County Origins to Out-of-County Destinations**. Trips passing through an individual jurisdiction while traveling from one county in the study area to another or outside the study area entirely.

E. **Background Traffic**. Trips made by persons preparing for the arrival of hurricane conditions; these trips are primarily shopping trips to gather supplies. In the coastal South Carolina area, trips from work to home to assist the family in evacuation could impact evacuation of coastal evacuees. Background traffic can also include transit vehicles (vans/buses) used to pick up evacuees without personal transportation.

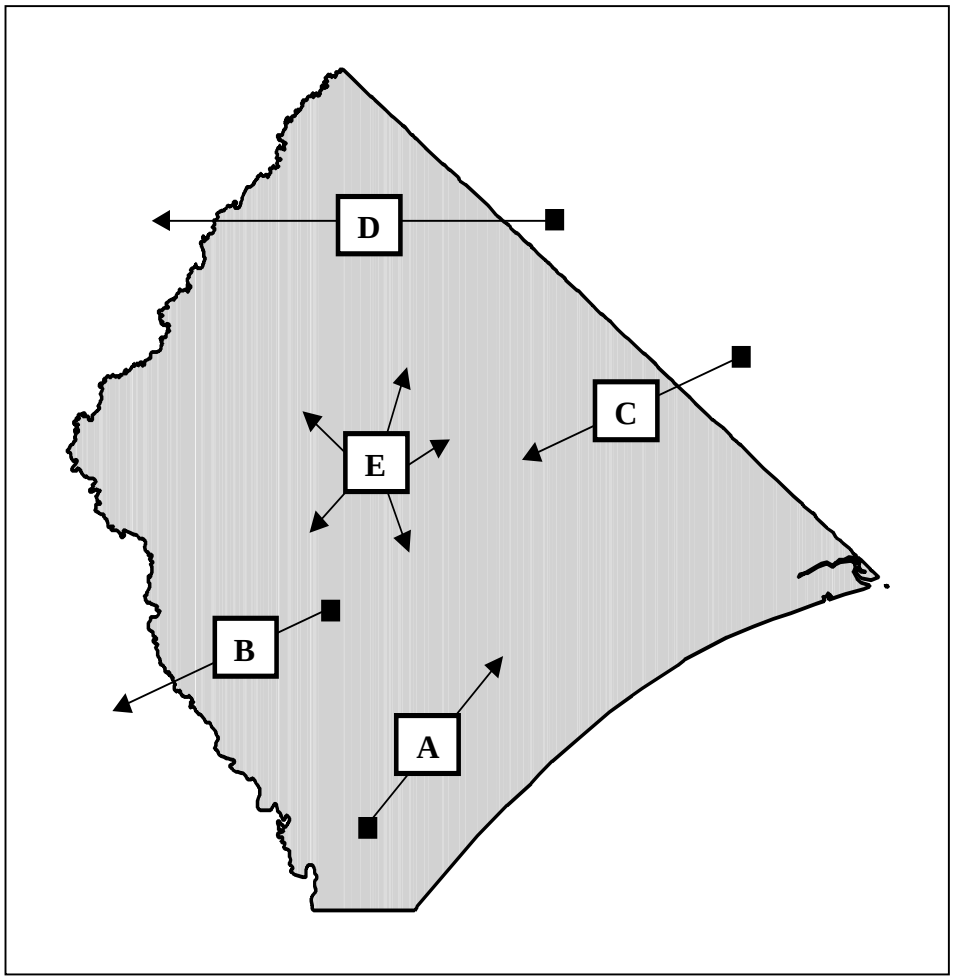


Figure 6-1 Evacuation Travel Patterns

Figure 6-1 graphically depicts these traffic movement patterns associated with hurricane evacuation situations in the coastal South Carolina Region (Horry County Example). It is important to recognize that three of the five defined patterns involve traffic movement patterns generated outside of one county's boundaries. It is evident that, depending on the assumed storm track, these inter-county movements can and do result in a number of regional traffic impacts. During the transportation analysis task, these movements were quantified to facilitate estimation of demand for roadway segment and resulting clearance times.

6.5 TRANSPORTATION ANALYSIS AND INPUT ASSUMPTIONS

The hurricane evacuation transportation modeling performed for the study area required a number of important data inputs and assumptions regarding anticipated evacuation behavior. All hurricanes differ from one another in some respect. Therefore, it is necessary to set forth clear assumptions about storm characteristics and evacuees' expected response before this type of transportation modeling could begin. Not only does a storm vary in its track, intensity and size, but also in the way it is perceived by residents in potentially vulnerable areas. These factors can cause a wide variance in the behavior of the vulnerable population. Even the time of day at which a storm makes landfall influences the parameters of an evacuation response.

The hurricane evacuation transportation analysis results in clearance times based on a set of assumed conditions and behavioral responses. It is likely that an actual storm will differ from a simulated storm for which clearance times are calculated in this report. Therefore, a sensitivity analysis was performed during the transportation modeling. Those variables having the greatest influence on clearance time were identified and then varied to establish the logical range within which the actual input assumption values might fall.

Key input assumptions guiding the transportation analysis are grouped into four areas:

A. Clearance Time Modeling Zones
B. Housing and Population Data
C. Behavioral Characteristics of the Evacuating Population
D. Roadway Network Assumptions

6.5.1. Clearance Time Modeling Zones

The first building block of the study was the development of a zone system for the transportation modeling. Hurricane evacuation studies focus on dwelling units within the potential storm surge flooded areas of a county and inland mobile homes which would be vulnerable to hurricane force winds. Figures 3-1 through 3-8 from Chapter 3 illustrate the zone systems developed for the analysis for the coastal counties. The zone boundaries were set up to relate to well known manmade or natural features, Traffic Analysis Zone (TAZ)/census boundaries, roadways and revised SLOSH storm surge mapping that came available in the spring of 1999.

One of the foremost challenges for the study, was describing who should evacuate in a way that is succinct and meaningful to the public and yet is responsive to anticipated storm surge limits for varying categories of hurricanes. One of several key startup tasks of the transportation analysis for the South Carolina Hurricane Evacuation Restudy was to work with the counties to delineate a general zone system that transportation modeling/clearance time calculations can be based upon. Meetings were held in early December 1997 and continued through February 1998 to focus on this issue. The state, Corps and counties were present at the meetings. While adjustments needed to be made to initial zone systems by September 1999, all counties had cooperated and agreed to a zone system which could be used for study purposes and which could be used in some format during the hurricane season for evacuating the public. Appendix A provides a verbal description of the evacuation zones for each county.

The evacuation zone systems described in Appendix A were set up to meet the following major objectives:

- Be describable over radio/TV media to the public
- Be based upon easily identifiable roadway or natural features for boundary identification
- Relate to storm surge limits based on the most recent SLOSH model runs
- In hard copy, allow coastal county residents to determine if their home is in a storm surge vulnerable evacuation area
- Be usable for transportation modeling/clearance time calculations
- Be related to census/traffic analysis zone boundaries for population and dwelling unit tabulations and calculation of vulnerable populations

6.5.2. Housing and Population Data

To develop the number of housing units and socioeconomic parameters for each evacuation zone, a variety of Year 2000 projections and 1990 Census data were assembled. This data was supplemented by current year mobile home and permanent occupied dwelling unit data provided by each county. Table 3-2 from Chapter 3 summarizes this data for each county. Many local planning departments and building departments contributed the best available counts of mobile homes and long range planning documents. Regional planning groups, such as the Waccamaw Regional Planning Council and the Low Country Council of Governments, provided population projections and copies of recent transportation studies. The State EPD gathered census data and mapping as well as key data items from the South Carolina Department Of Transportation (SCDOT). The resulting database for this hurricane study was one of the cleanest and best developed compared to other studies around the country. The Transportation Model Support Document (under separate cover) provides the data by clearance time modeling zone. Chapter 3 – Vulnerability Analysis contains figures with county maps depicting permanent occupied dwelling units, mobile home units, conglomerate mobile homes, seasonal dwelling units, and evacuation population.

6.5.3. Behavioral Characteristics of the Evacuating Population

Section 4.2 from Chapter 4 summarizes the key behavioral concepts and assumptions used in the study. The Transportation Model Support Document provides all of the specific parameters used for each zone and county for all scenarios.

6.5.4 Roadway Network Assumptions

A final group of assumptions used for input to the transportation analysis is related to the roadway system chosen for the evacuation network and traffic control measures considered for traffic movement. Although the assumptions developed for the transportation analysis are general, the efforts at state, county and municipal levels regarding traffic control and roadway selection must be quite detailed. In heavily urbanized areas, like Charleston and Myrtle Beach, many intersections will be controlled by existing traffic signals. However, as resources permit, traffic control officers will be stationed at bottlenecks identified in this study as well as other local locations of concern. Detailed law enforcement assignments to major bottlenecks involves extensive coordination among local and state officials. The State of South Carolina has already prepared a traffic control annex to the state hurricane plan, which makes the agency assignments to specific intersections. These traffic control points must be manned during a major evacuation and are listed in the most current South Carolina State Hurricane Plan.

Primary evacuation routes modeled in this study were those provided by the state for the 1999 hurricane season. As this study is being published, the South Carolina Department of Transportation (SCDOT) is evaluating and changing several of the designated primary routes. Traffic control points and assigned responsibilities are also being modified to reflect lessons learned during the Hurricane Floyd evacuation. (For example, SCDOT and South Carolina Highway Patrol (SCHP) will route Dorchester Road traffic onto S-22 and then to US 78 in Dorchester County for the 2000 hurricane season. US Highway 78 through Summerville was also added as a route this year.) However, the changes being discussed and implemented should not significantly change the clearance times developed in the study due to the location of the identified bottlenecks and origins of traffic. The changes will help the flow of traffic on secondary routes and the study already assumed that a portion of the coastal counties' traffic would use the secondary routes.

In choosing roadways to be used for the evacuation network, effort was made to include road facilities with sufficient elevations, little or no adjacent tree coverage, substantial shoulder width and surface, and roadways already contained in existing hurricane evacuation plans. In an area such as coastal South Carolina, where there are urban and rural low lying streets that flood in heavy rainfall events, these criteria are difficult, if not impossible, to meet.

In order to determine the routing of evacuation, a representation of the roadway system was developed. A "link-node" system was developed to identify roadway sections. Nodes are used to identify the intersection of two roadways or changes in roadway characteristics. Links are the roadway segments as defined by the nodes when connected. Each link is identified by a letter designation. Figures 6-2 through 6-9 illustrate the coded evacuation network with link names and zone connections to the links shown by open circles and dashed lines.

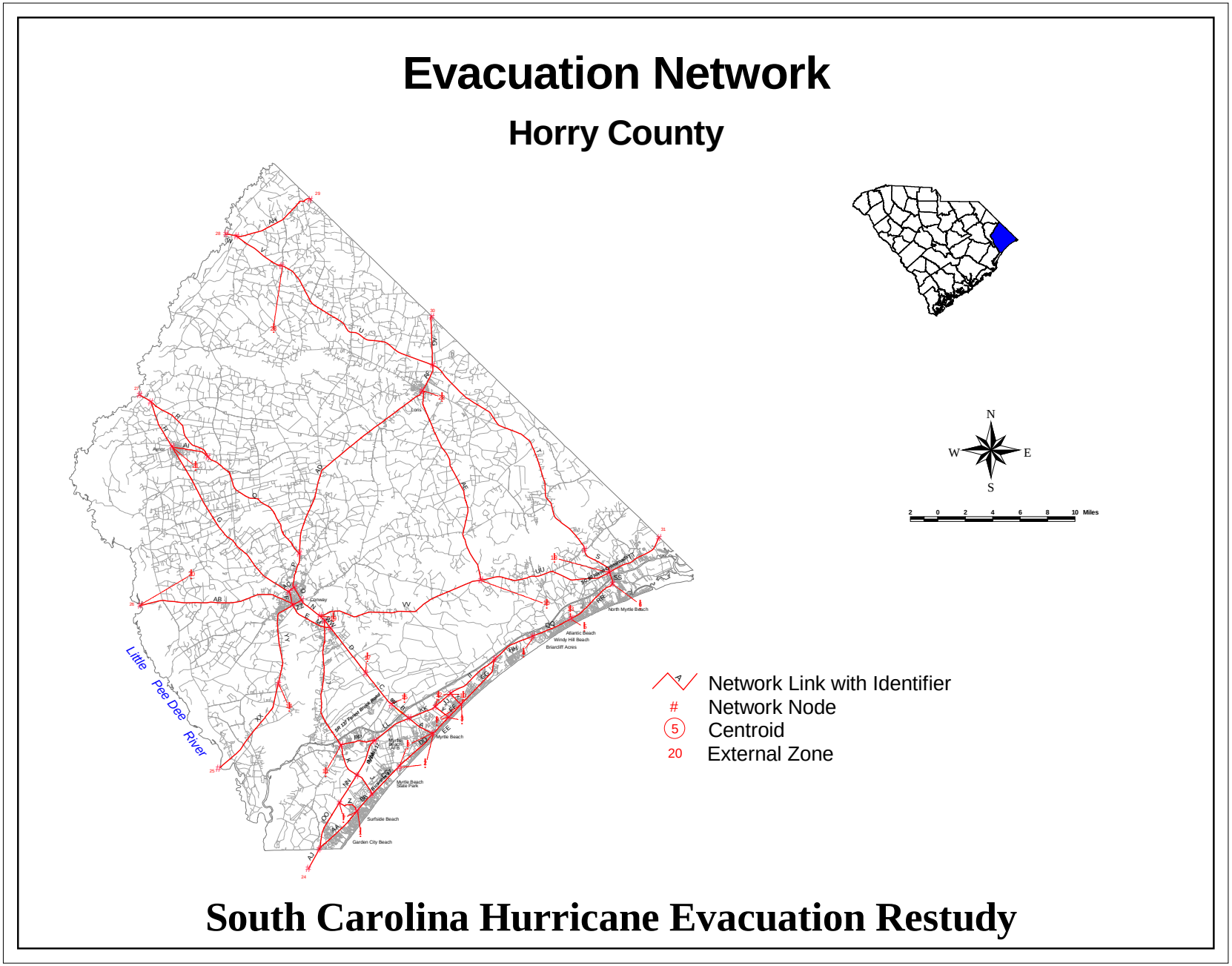


Figure 6-2. Evacuation Network – Horry County

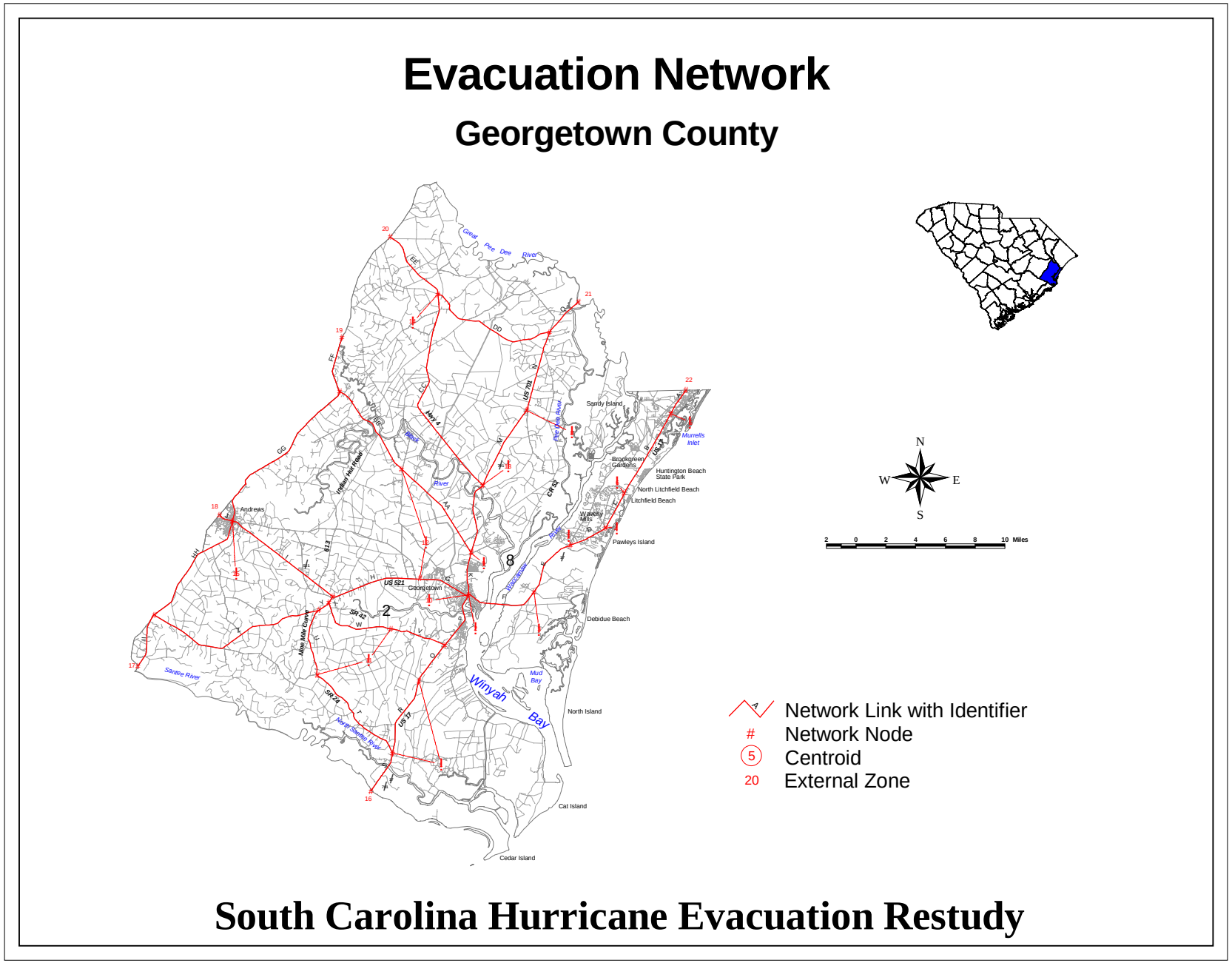


Figure 6-3. Evacuation Network – Georgetown County

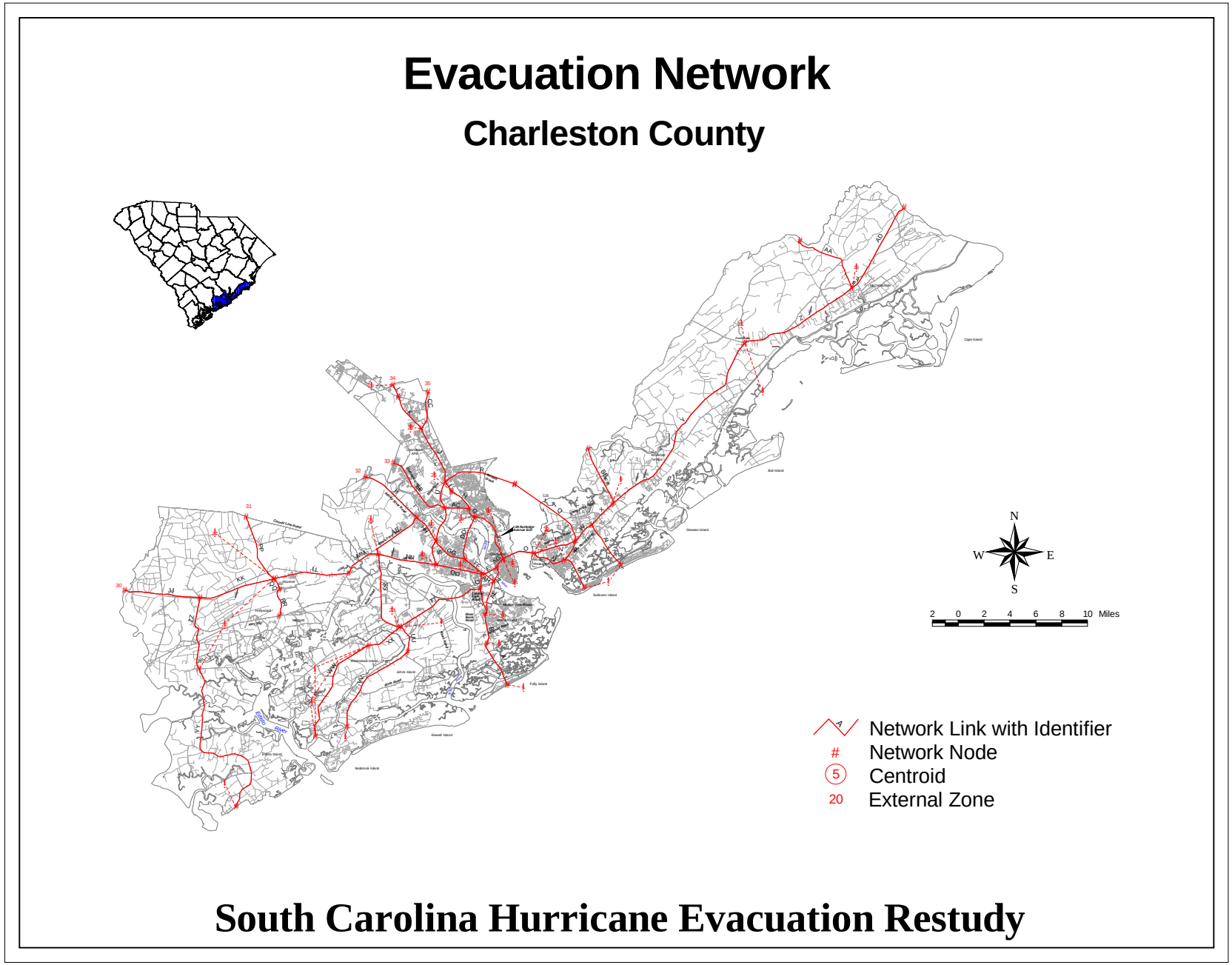


Figure 6-4. Evacuation Network – Charleston County

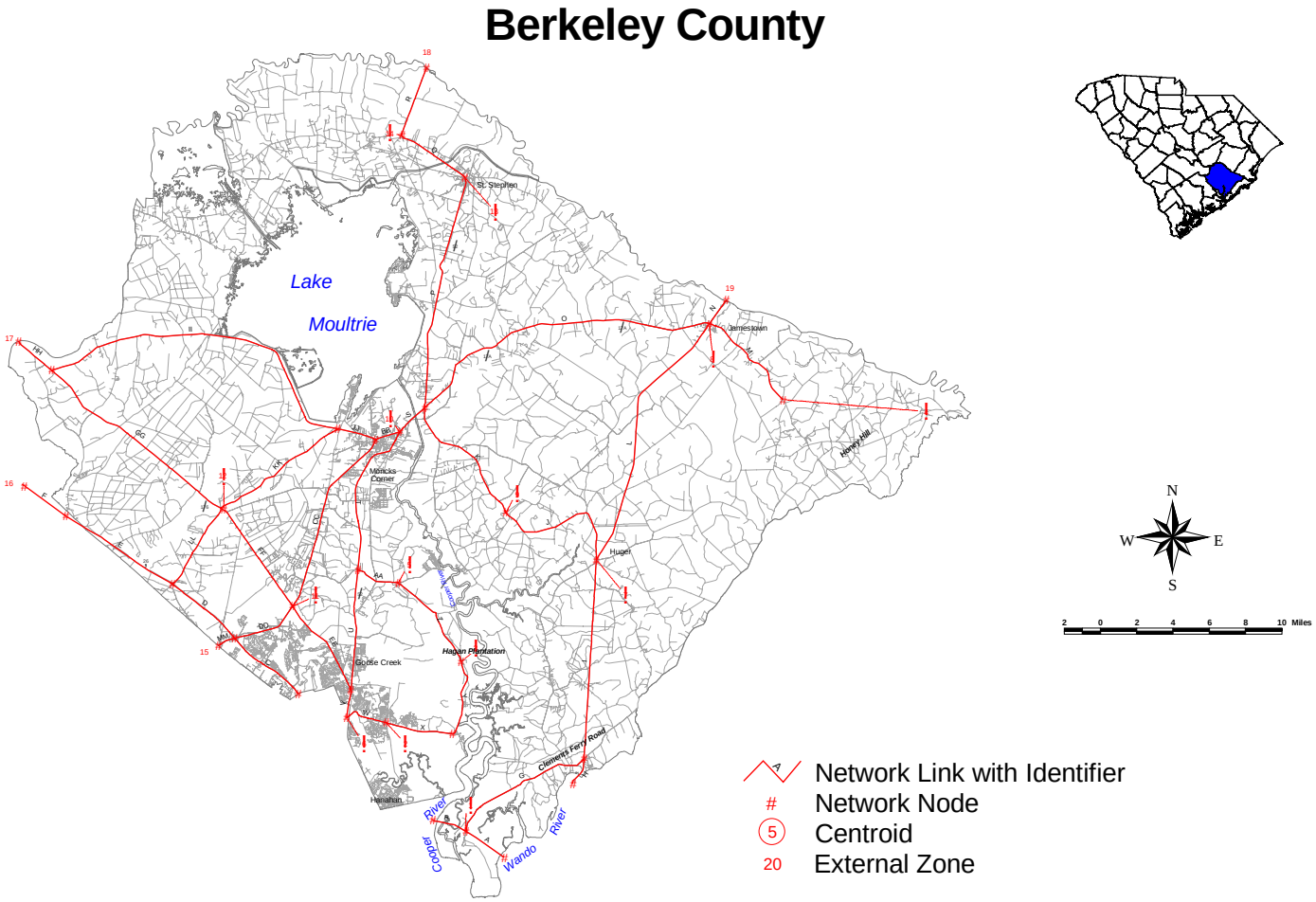


Figure 6-5. Evacuation Network – Berkeley County

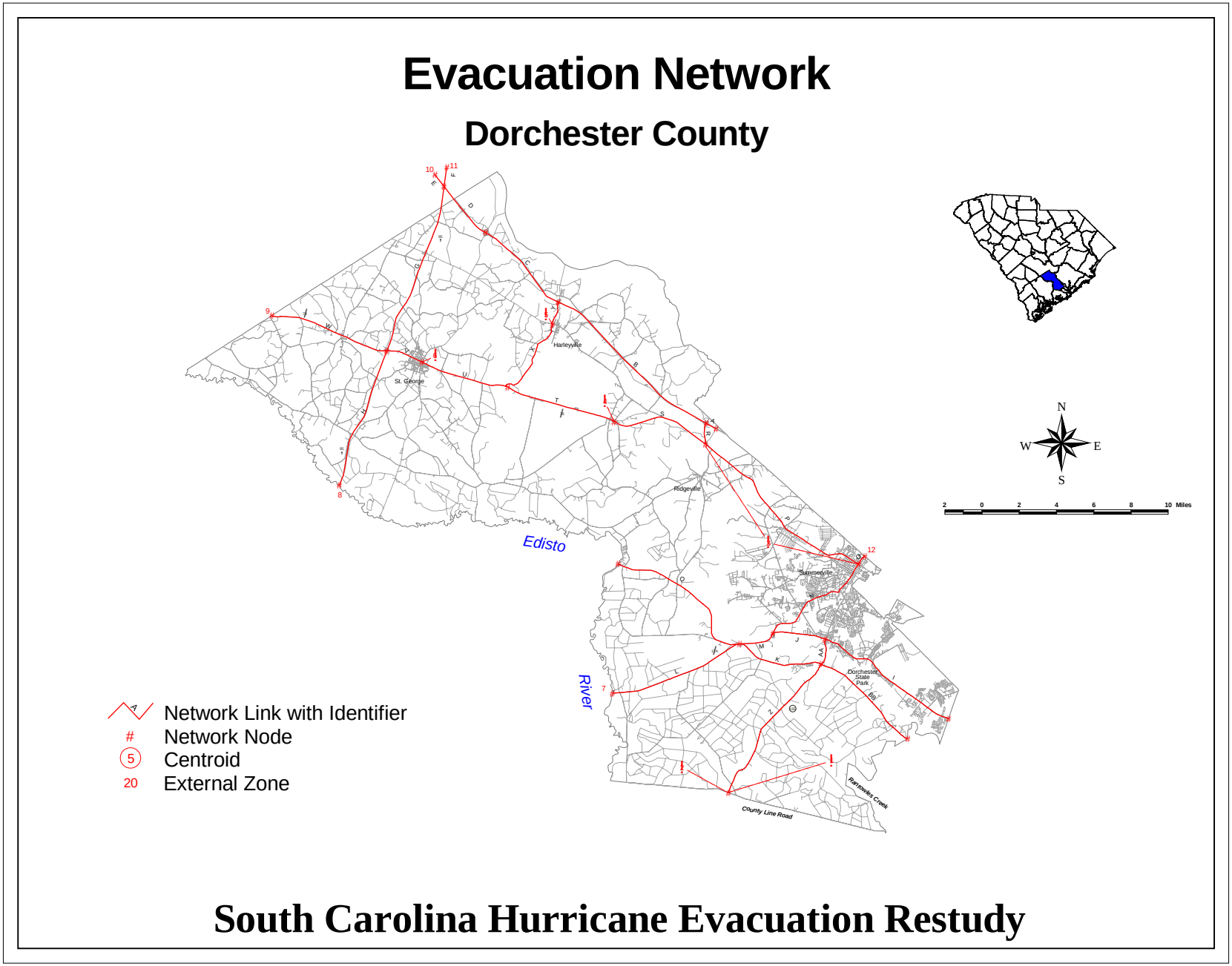


Figure 6-6. Evacuation Network – Dorchester County

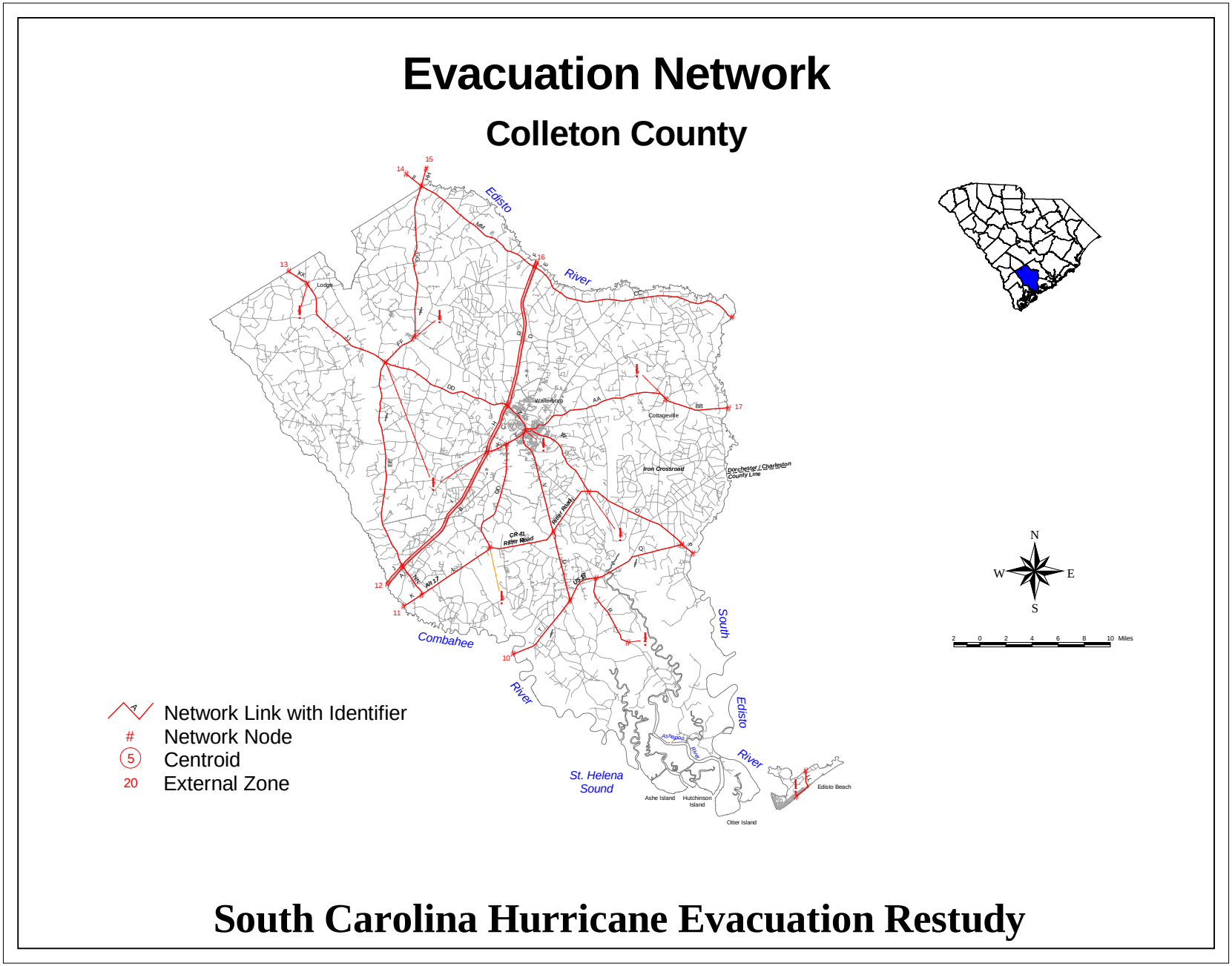
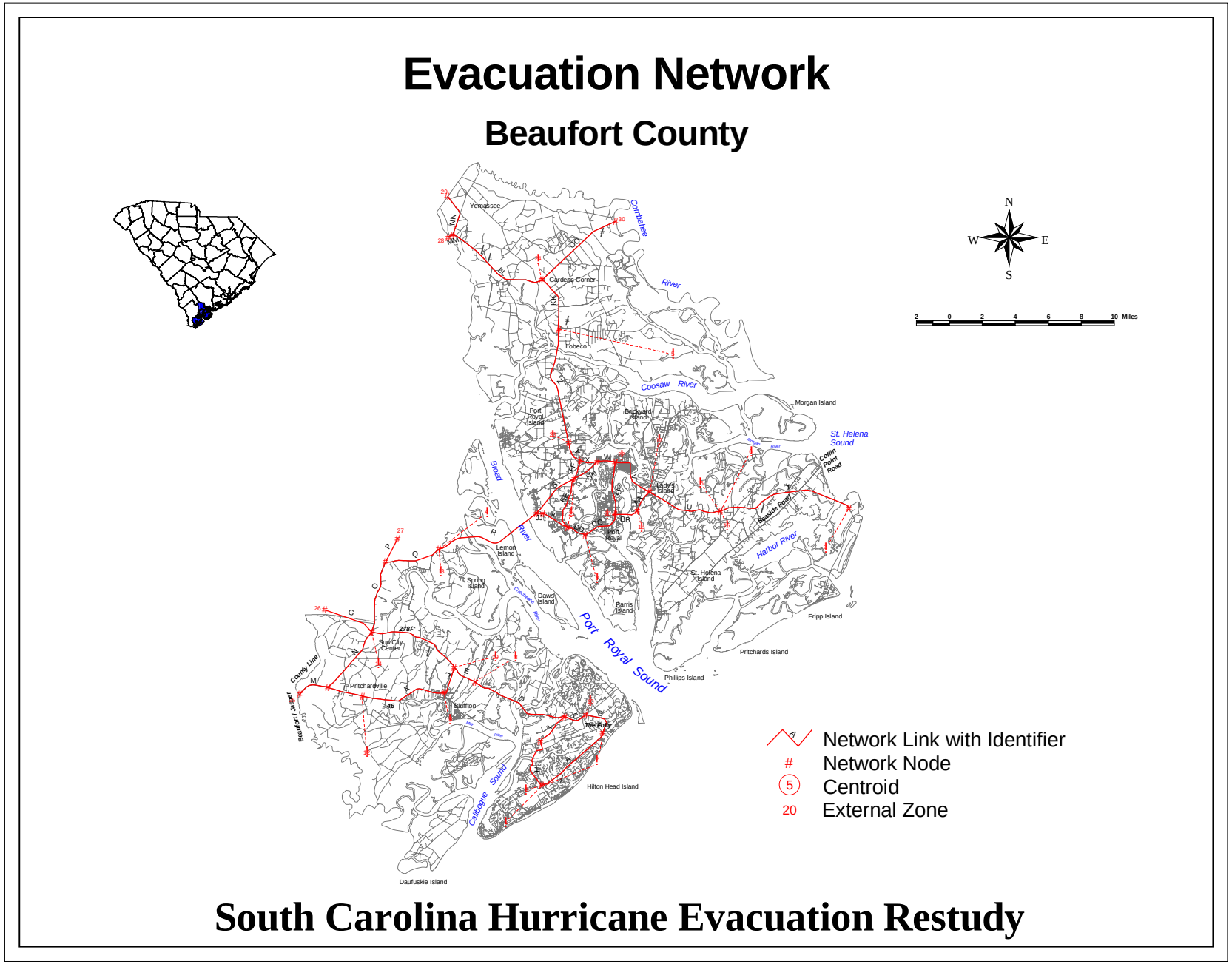


Figure 6-7. Evacuation Network – Colleton County



South Carolina Hurricane Evacuation Restudy

Figure 6-8. Evacuation Network – Beaufort County

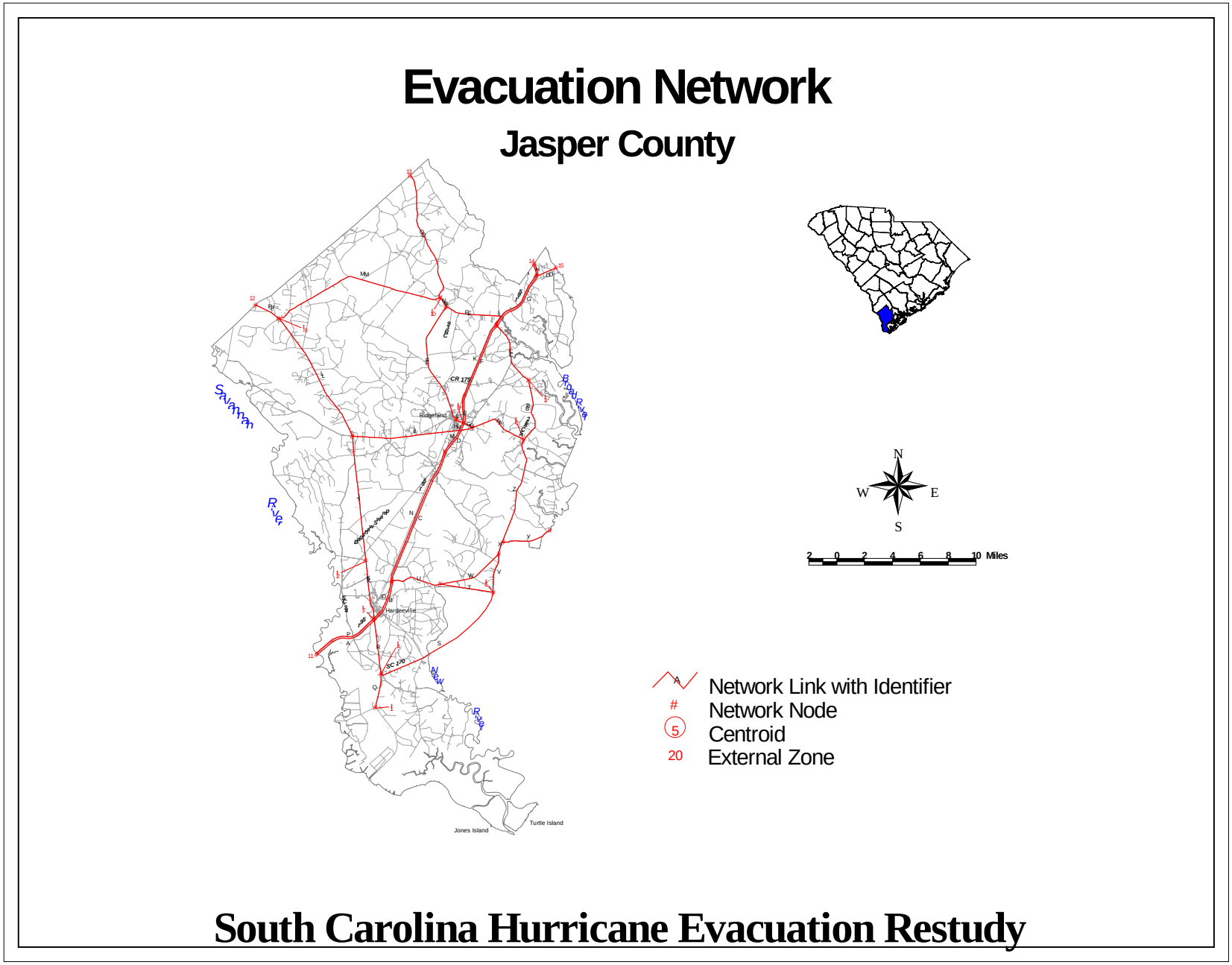


Figure 6-9. Evacuation Network – Jasper County

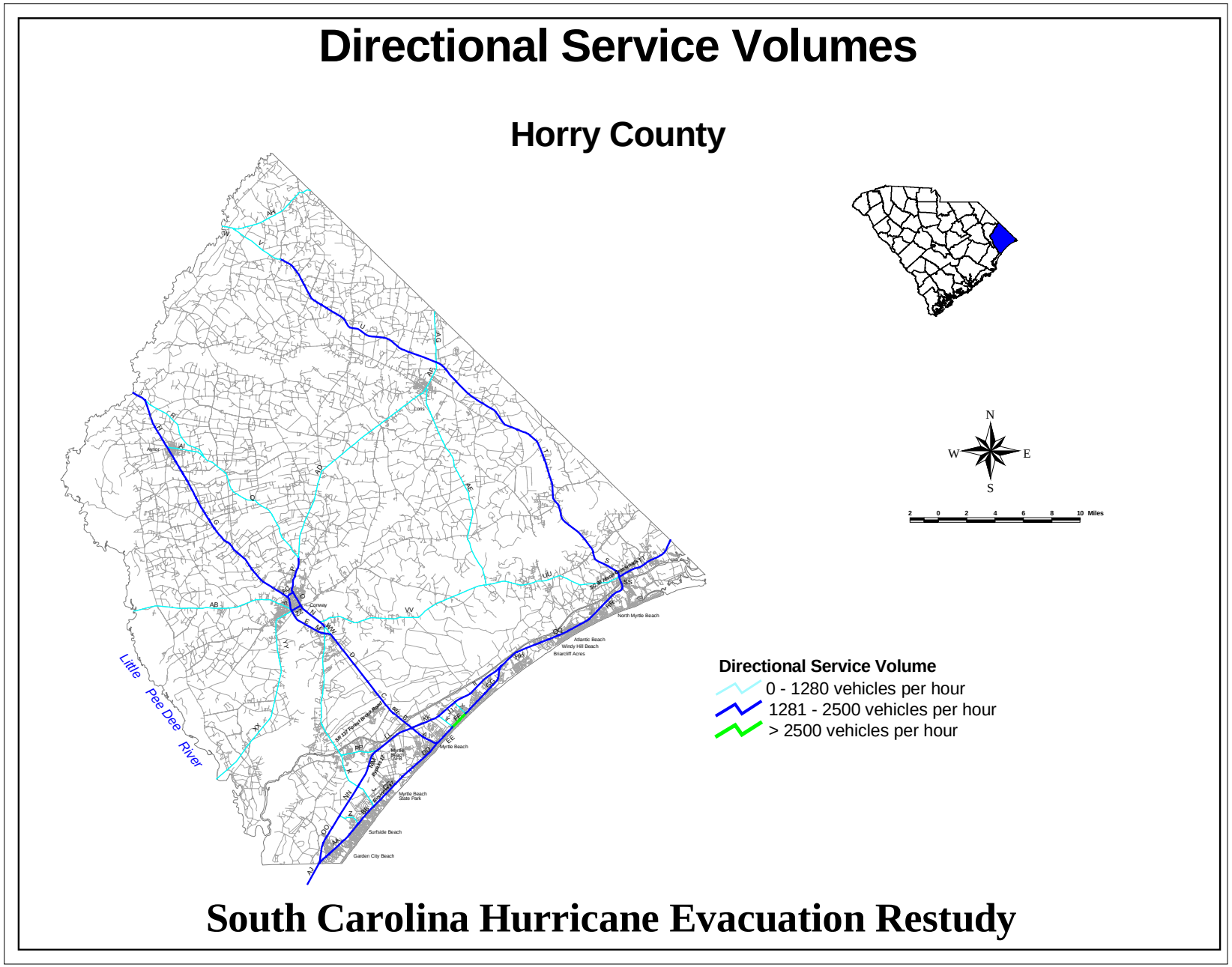


Figure 6-10. District Service Volumes, Horry County

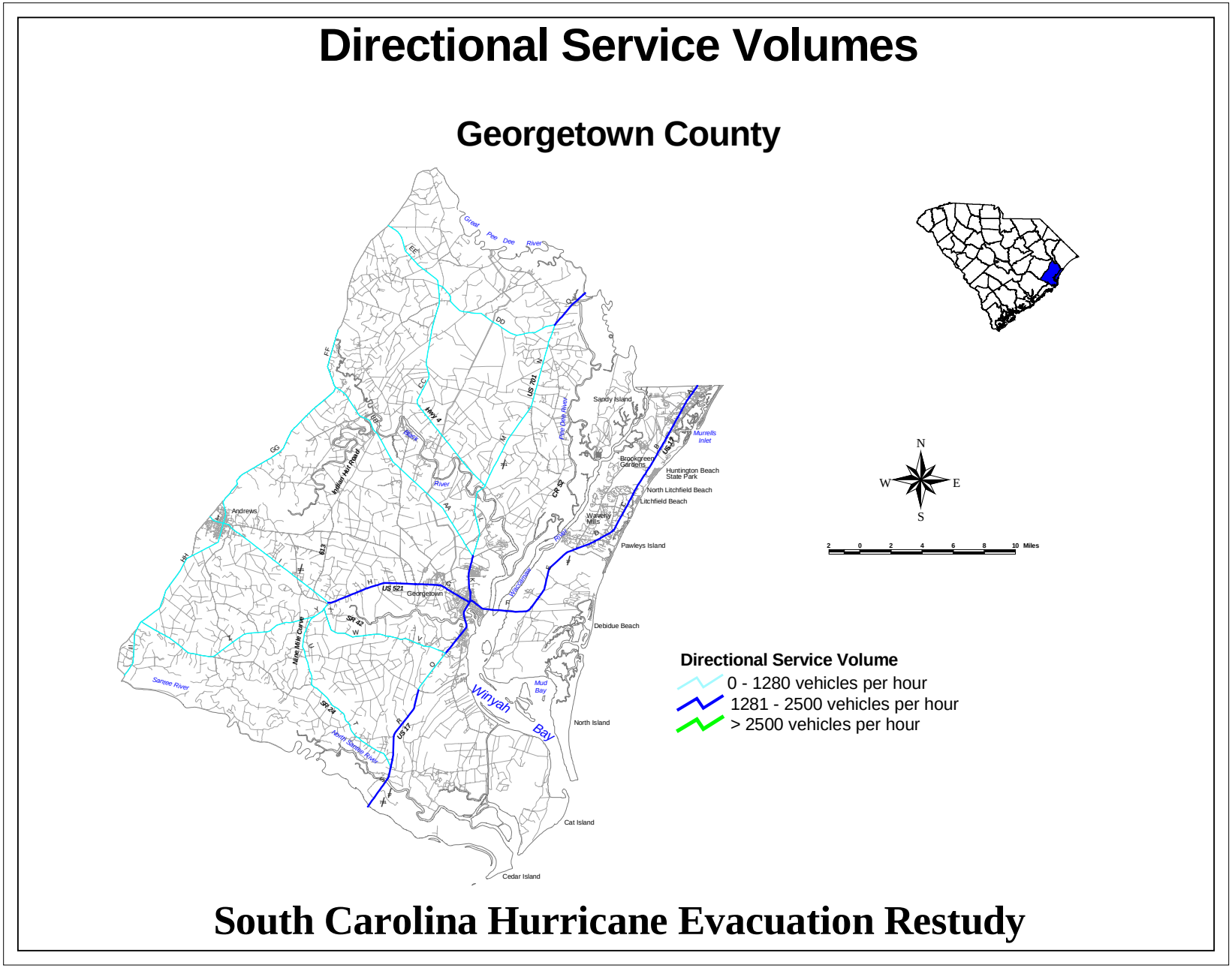


Figure 6-11. Directional Service Volumes, Georgetown County

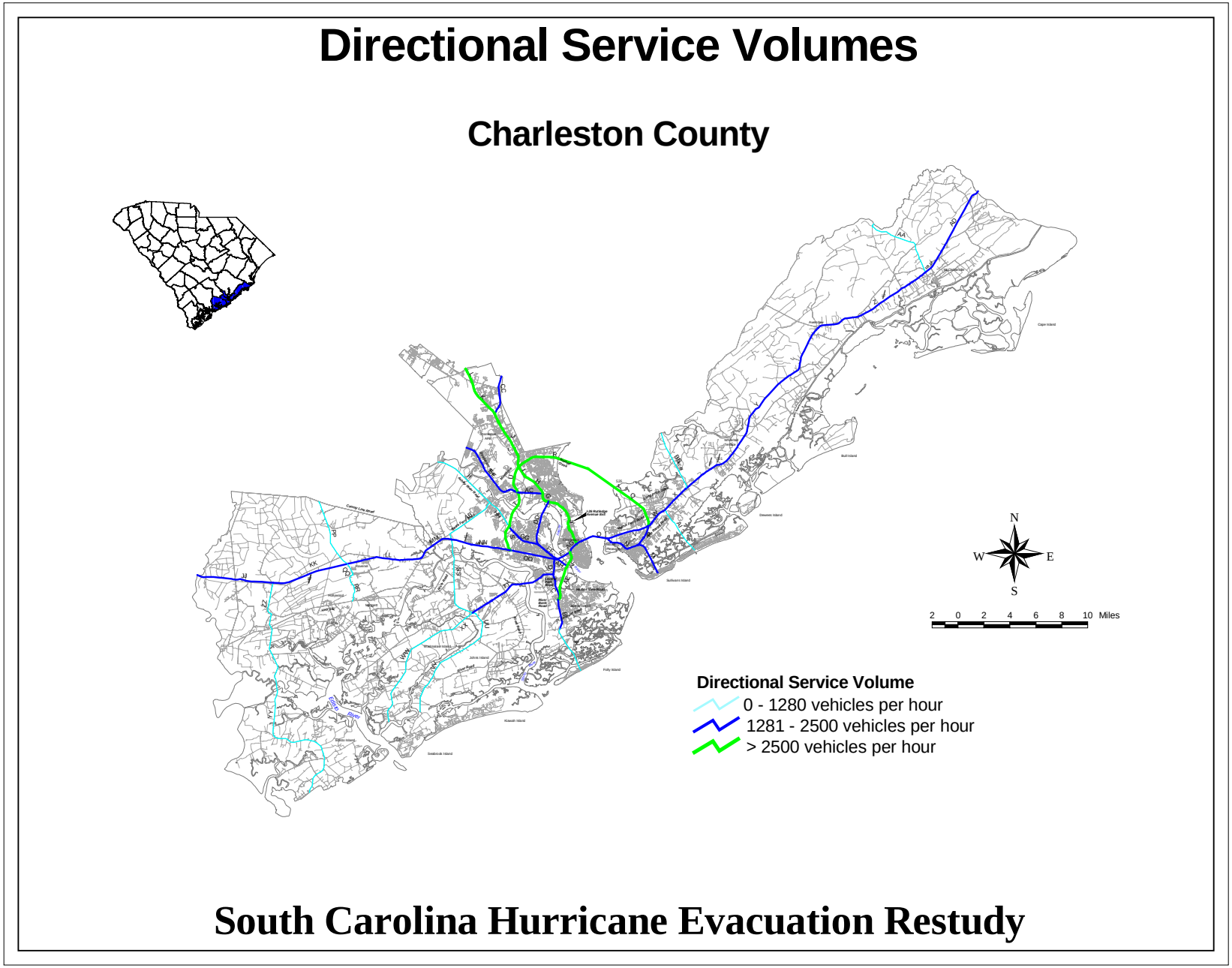


Figure 6-12. Directional Service Volumes, Charleston County

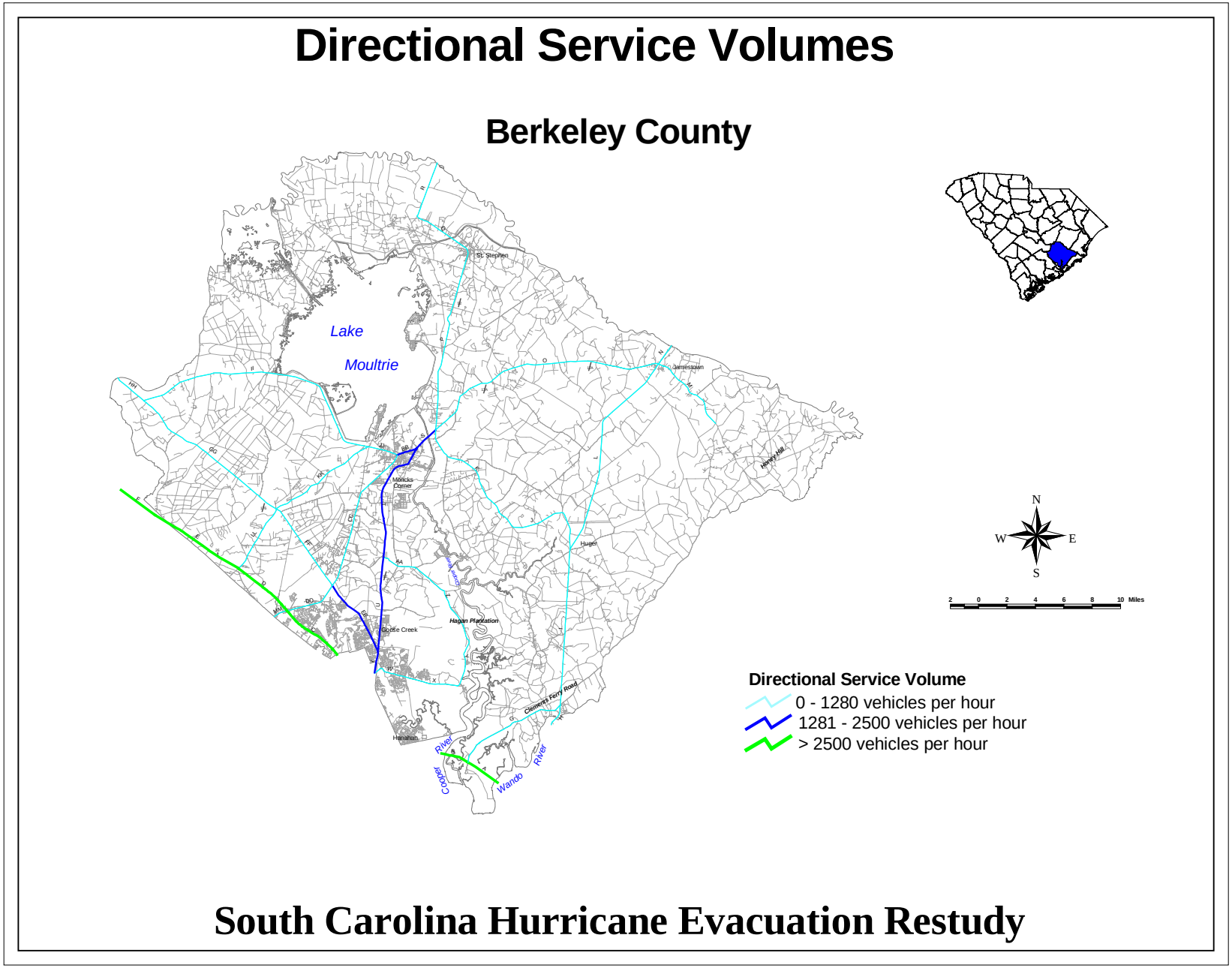


Figure 6-13. Directional Service Volumes, Berkeley County

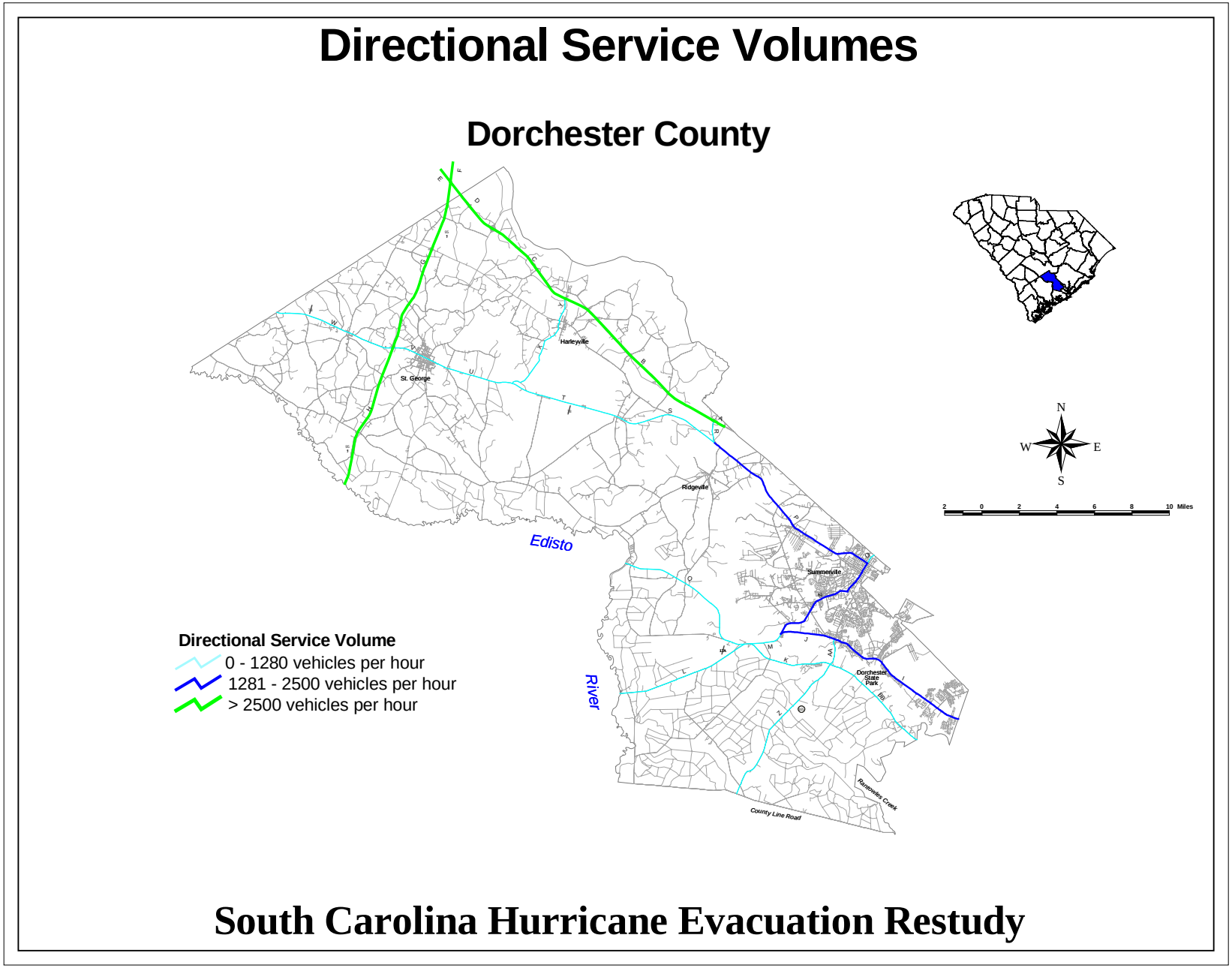


Figure 6-14. Directional Service Volumes, Dorchester County

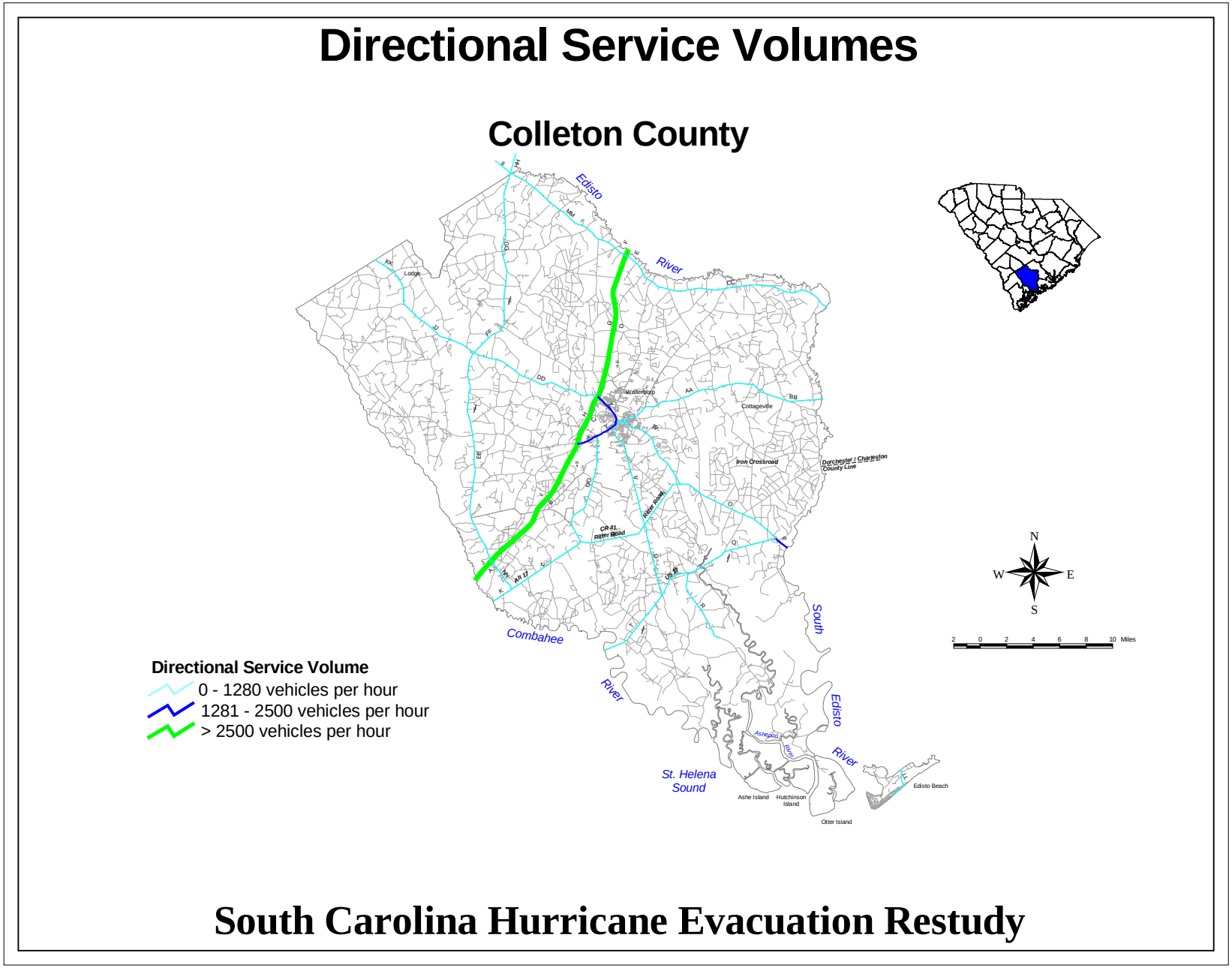
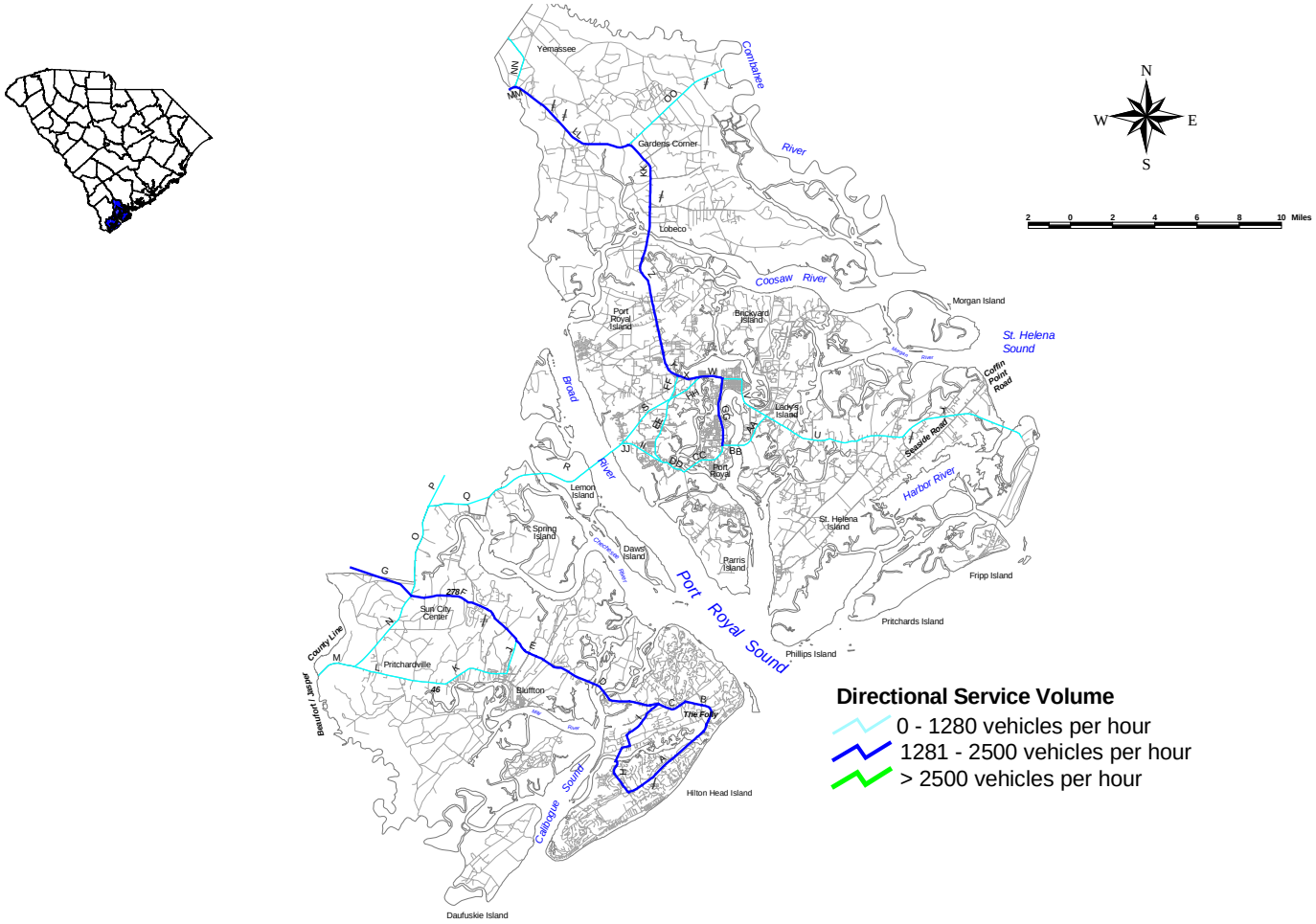


Figure 6-15. Directional Service Volumes, Colleton County

Directional Service Volumes

Beaufort County



South Carolina Hurricane Evacuation Restudy

Figure 6-16. Directional Service Volumes, Beaufort County

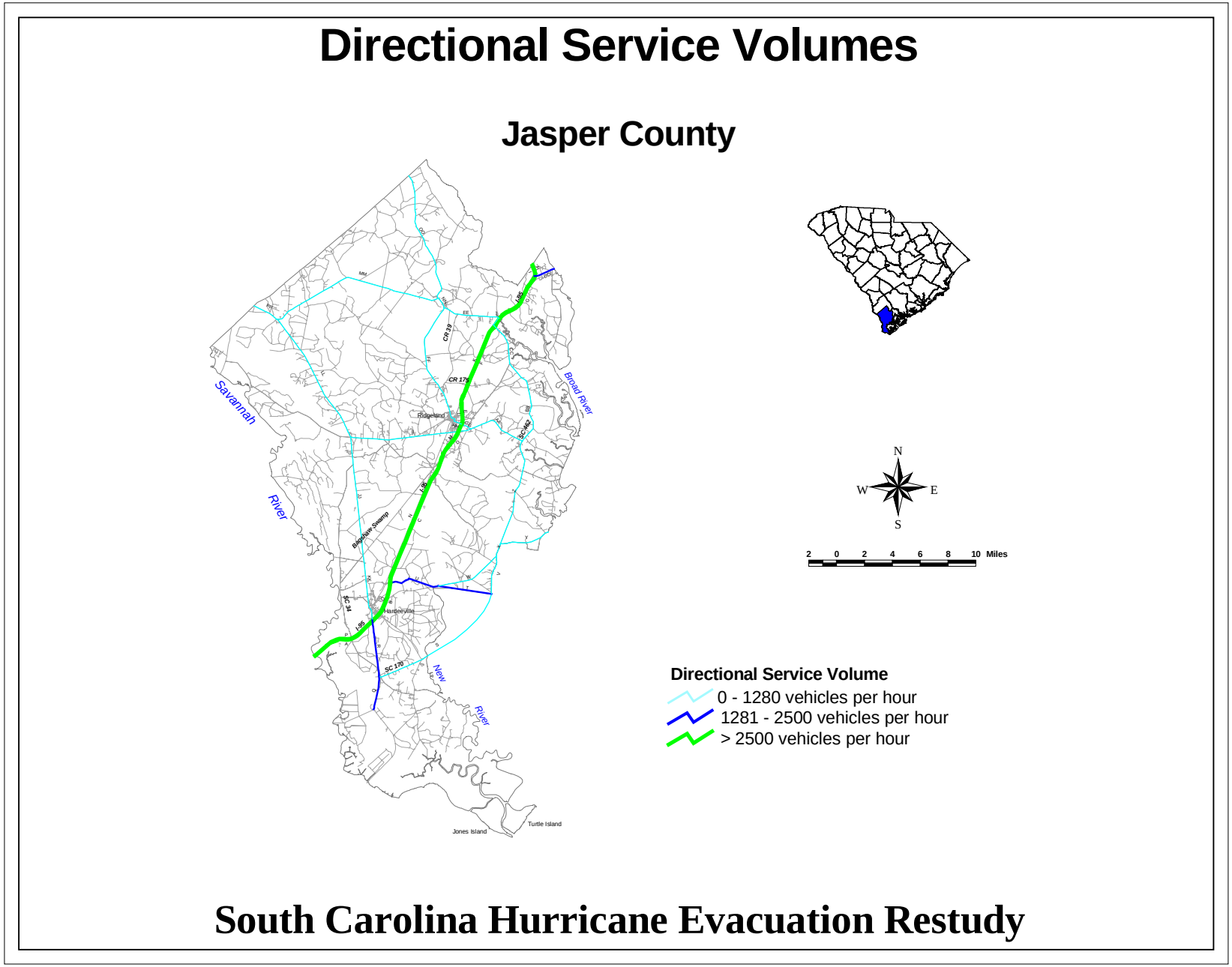


Figure 6-17. Directional Service Volumes, Jasper County

Once the links and nodes were established for the evacuation routes, directional traffic service volumes at Level of Service D were established for each link for the Year 2000 scenario based upon the primary evacuation routes designated by the SCDOT for the 1999 hurricane season. This was accomplished by ascertaining number of lanes and facility type, through information from the SCDOT and "field checks"/updating. Tables were then used to specify a directional, level of service D service volume based on link characteristics. Figures 6-10 through 6-17 show the Year 2000 scenario directional service volumes and number of lanes for the evacuation clearance time analysis.

Important assumptions concerning the evacuation road network for the analysis, which must be mentioned, are:

- The evacuation of all vehicles will occur prior to the arrival of sustained tropical storm winds (39 mph) and storm inundation of evacuation routes

- Provisions will be made for the removal of vehicles in distress on the network through aggressive incident management and agreements worked out with tow truck operators

- Signal timings will be "actuated" to provide the most green time for westbound movements away from the coast

- The SCDOT will be contacted to "lock down" draw bridges once evacuation orders or advisories are issued

Traffic control points listed in the state's traffic control annex to the state hurricane plan will be manned and actively managed

6.6 CLEARANCE TIME MODEL APPLICATION / SYSTEM FORECASTS

Application of the transportation modeling methodology for hurricane evacuations, using inputs and assumptions discussed in Chapter 3, produced several key data items and forecasts for hurricane evacuation planning and preparedness. Completion of the transportation modeling for the Year 2000 scenario produced the following:

- Evacuating people and vehicle statistics by evacuation zone by storm scenario
- Shelter demand and capacity considerations by scenario
- Traffic volumes and critical roadway segments by scenario
- Estimated clearance times by scenario

Although a wealth of data is produced in the transportation analysis (as provided in the Transportation Model Support Document), the items listed above are the most critical outputs for planning for shelter needs, anticipating bottlenecks, and defining the timing requirements of an evacuation.

6.7 Clearance Time Modeling Description

The general philosophy supporting all of the hurricane evacuation clearance time work around the country is that the analysis must be sophisticated enough to produce reliable estimates of hurricane evacuation clearance time, yet clear enough for the emergency management community to be able to understand key modeling assumptions and products. This section provides a brief overview of the analysis steps and description of the computer program framework for accomplishing the modeling steps. The key steps are as follows:

~ Development of Clearance Time Modeling Zones and Data - identifies <u>who</u> is vulnerable and evacuating.

~ Trip Generation - calculates <u>how many</u> evacuees will move by county sub area for a particular scenario

~ Trip Distribution - determines <u>where</u> evacuees will go

~ Development of Evacuation Road Network - addresses what are the roads that can be used for evacuation and what is the carrying capacity

~ Trip Assignment - determines <u>what route(s)</u> evacuees will take to get from their origin to their destination.

~ Calculation of Clearance Time - determines <u>how much time</u> it will take for all evacuees to clear the evacuation network.

Figure 6-18 illustrates the major inputs and outputs of this process. Computer programs were used to facilitate the transportation modeling work steps described above. These programs are in a Lotus for Windows environment and were developed for all ongoing hurricane work. The S.C. Restudy is the beneficiary of a brand new clearance time calculation module that was developed after Hurricane Floyd to take advantage of real time carrying capacity observations and traffic loading/queuing estimates. To facilitate the states' and counties' ability to update clearance times when large developments come on line or when road construction restricts normal flow, the state is being provided with a model spreadsheet to make these adjustments in a simplified fashion.

6.7.1. Evacuating People and Vehicles By Scenario

Using trip generation software, total evacuating people and vehicles produced by each zone were calculated and split by general destination type (trip purpose). The four general destination types are in-county public shelter, in-county hotel/motels, in-county home of a friend or relative, and out-of-county. This was accomplished for the Year 2000 scenario, for each storm intensity and for two levels of assumed tourist occupancy (for those counties where tourist occupancy was a large factor).

Table 5-1 (Chapter 5 - Shelter Analysis) shows the numbers of people estimated to leave dwelling units for each county and scenario. <u>Numbers of people involved in an actual evacuation will most likely be less than these figures</u> because 100 percent participation of units in storm surge vulnerable evacuated areas and all mobile homes was assumed for the scenarios. Even with door-to-door evacuation notification, it will be difficult to convince all to leave who should leave.

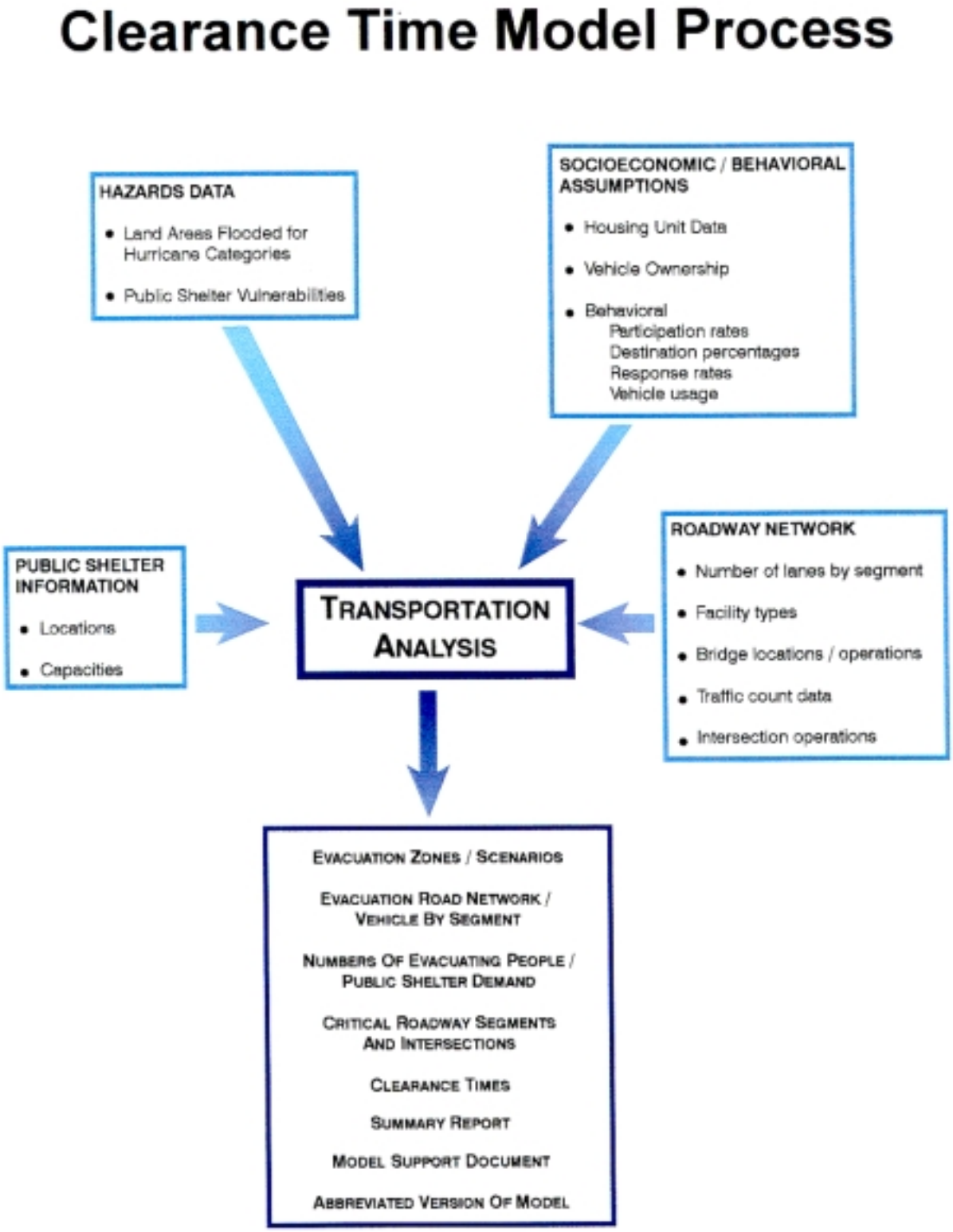


Figure 6-18. Clearance Time Modeling Process

6.7.2. Evacuation Traffic Volumes and Critical Roadway Segments

The Transportation Model Support Document Appendix provides the assigned evacuating vehicle figures by roadway segment for each Year 2000 storm scenario by county. In addition, the Appendix provides an evacuating vehicles to service volume ratio calculated for each roadway segment by scenario. Those segments with the highest evacuation vehicles to service volume ratio were considered to be critical links for evacuation under a particular scenario. These congested areas control the flow of evacuation traffic during a hurricane evacuation and are key areas for traffic control and monitoring. (These ratios should not be confused with the v/c ratios used in traffic engineering to describe Level of Service). Many of these same roadways will be carrying not only the evacuating public, but also the non-evacuating public attempting to gather supplies and fuel for homes and vehicles.

Table 6-1 lists the roadway segments in each county that will control the flow of evacuation traffic. In terms of major hurricanes, one must look at the Georgia bottlenecks noted in the table beyond the South Carolina border. Table 6-2 provides potential numbers of evacuating vehicles which could exit South Carolina and enter Georgia on I-95. Figures 6-19 through 6-26 illustrate potential evacuation traffic congestion by roadway segment by storm scenario, county and conglomerate. Congestion levels are based upon the assumption that all traffic control points will be manned and actively managed.

Table 6-1

CRITICAL ROADWAY LOCATIONS
NORTHERN CONGLOMERATE COUNTIES
South Carolina Hurricane Evacuation Restudy

COASTAL

Horry County

US 501 between US 17 Bypass and Conway
Business 501 from SC 544 through Conway
US 501 and SC 319 intersection at Gallivants Ferry
21st Street and US 17 Bypass intersection
US 501 Bypass through Conway
SC 319 and US 701 intersection north of Conway
SC 9 and US 76 intersection

Georgetown County

US 521 from Alt 17 through Andrews
US 17/US 701/US 521 intersection in Georgetown
US 521/Alt 17 through Georgetown

INLAND

US 501 and US 76 intersection at Marion (Marion County)
US 521 and US 52 intersection (Williamsburg County)
US 521 through Manning (Clarendon County)
US 76/US 301 through Florence (Florence County)
I-95 northbound on ramps (Florence and Dillon Counties)
US 521/US 378 intersection in Sumter (Sumter County)
I-20 westbound on ramps (Darlington and Lee Counties)

Table 6-1 (Continued)

CRITICAL ROADWAY LOCATIONS
CENTRAL CONGLOMERATE COUNTIES
South Carolina Hurricane Evacuation Restudy

COASTAL

Charleston County

I-26 and Mark Clark Expressway interchange
Folly Road south of new James Island Bridge connector
I-26/I-95 interchange (in Orangeburg County)
I-26 north of Exit 208/US 52 connector (3 NB to 2 NB lane transition)
Maybank Highway and Folly Road intersection
I-26 from Cosgrove Avenue to Mark Clark Expressway
Cooper River Bridge (US 17) and I-526 high level structures (wind vulnerability)

Dorchester County

I-26
Main Street through Summerville
University Blvd. and Main street intersection

Berkeley County

I-26
US 52 through Moncks Corner
Alt 17 and I-26 interchange

INLAND

I-26/I-95 interchange (in Orangeburg County)
US 21 intersections through Orangeburg
I-26 and I-77 interchange (in Lexington County)
I-20 and I-77 interchange (in Richland County)
SC 61 at Alt17 area

Table 6-1 (Continued)
CRITICAL ROADWAY LOCATIONS
SOUTHERN CONGLOMERATE COUNTIES
South Carolina Hurricane Evacuation Restudy

COASTAL

Beaufort County
(South of Broad River)

US 278 from Cross Island Parkway to Burnt Church Road
Cross Island Parkway and William Hilton Parkway interchange
Hilton Head connector I-95 interchange in Jasper County
I-16 westbound on ramp from I-95 (in Savannah)

(North of Broad River)

US 21 and Lady's Island Drive
US 21 and US 17 intersection at Garden's Corner
US 21 through Beaufort
US 21 and SC 280 intersection

Jasper County

Hilton Head connector I-95 interchange
US 278 through Ridgeland
US 17/I-95 interchange

Colleton County

Alt 17 through Walterboro
SC 64 through Walterboro
SC 174 and US 17 intersection (in Charleston County)

INLAND

US 278 through Hampton (in Hampton County)
US 278 and SC 64 intersection in Barnwell (in Barnwell County)
US 21 through Orangeburg (in Orangeburg County)
US 301 and US 278 intersection (in Allendale County)
SC 68 and US 278 intersection (in Hampton County)

Table 6-2

SOUTH CAROLINA EXITING TRAFFIC
TO GEORGIA VIA I-95 BY STORM SCENARIO
South Carolina Hurricane Evacuation Restudy

STORM CATEGORY	MAXIMUM POTENTIAL I-95 TRAFFIC INTO GEORGIA
Category 1-2 Low tourist occupancy	8,100 vehicles
Category 1-2 High tourist occupancy	12,400 vehicles
Category 3-5 Low tourist occupancy	13,300 vehicles
Category 3-5 High tourist occupancy	16,400 vehicles

*** Once the Georgia Hurricane Evacuation Restudy Transportation Analysis is accomplished (Summer 2000), a reciprocal table of traffic entering South Carolina from Georgia will be available.**

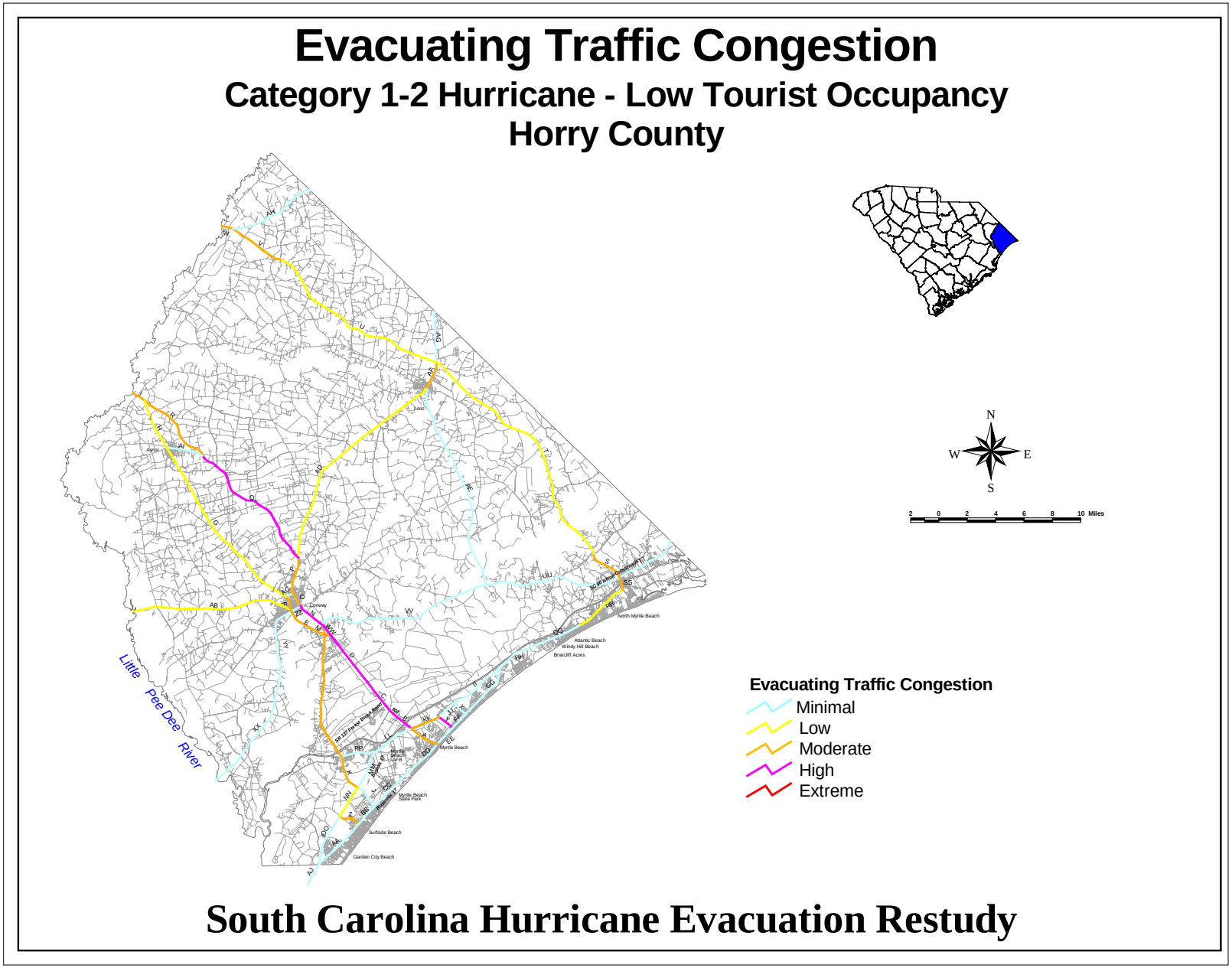


Figure 6-19. Evacuating Traffic Congestion Cat 1-2 Hurricane Low Tourist Occupancy, Horry County

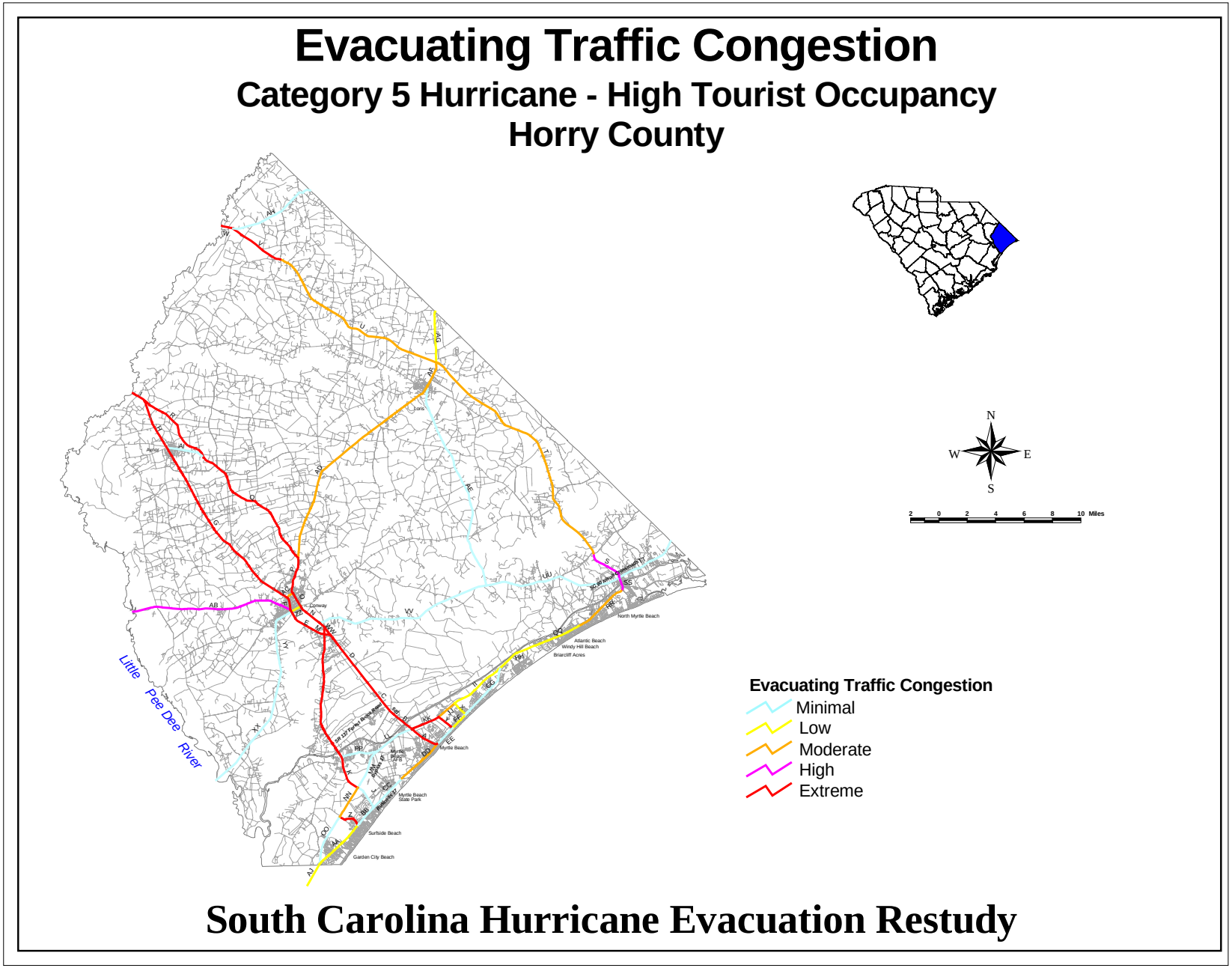


Figure 6-20. Evacuating Traffic Congestion Cat 5 Hurricane High Tourist Occupancy, Horry County

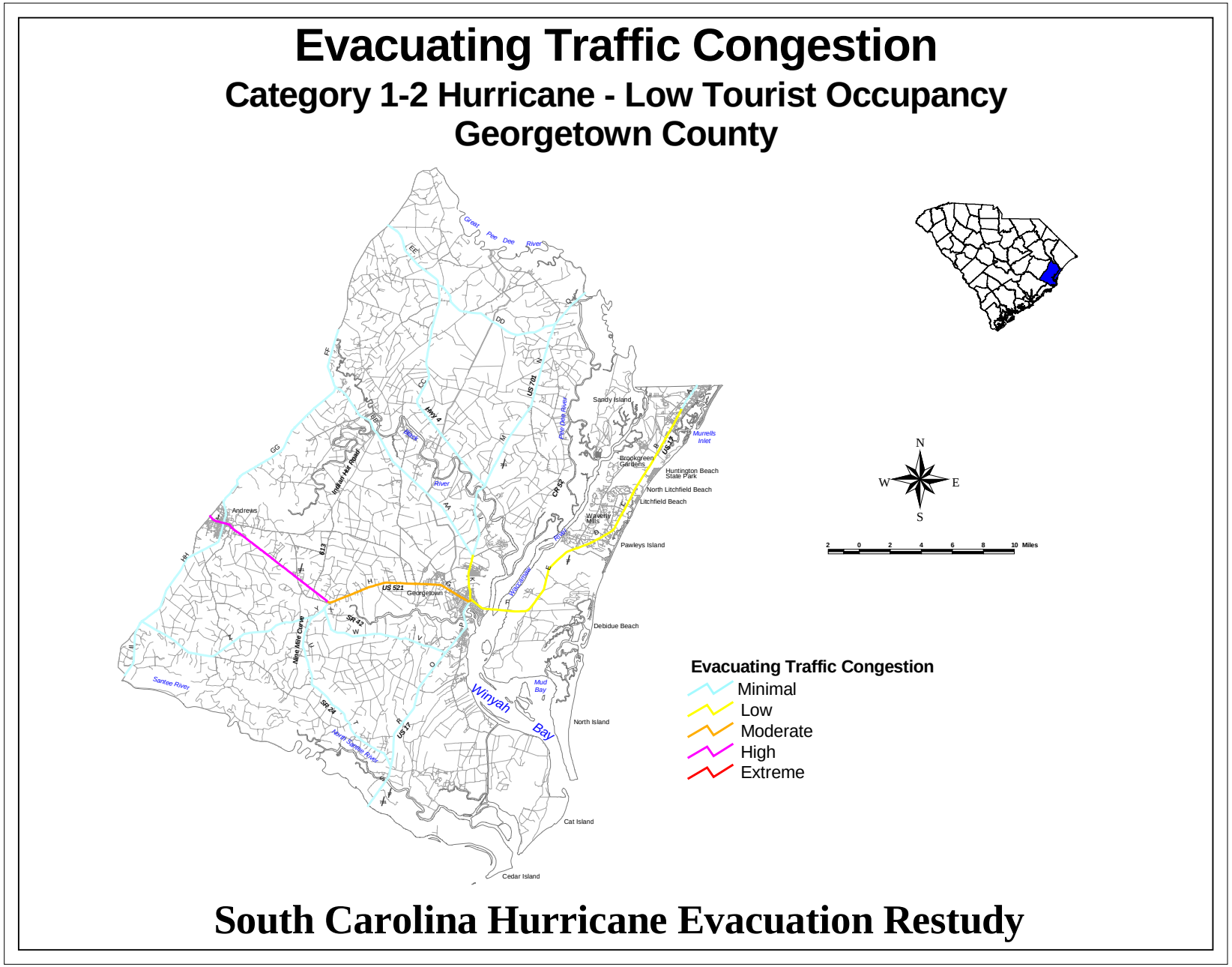


Figure 6-21. Evacuating Traffic Congestion Cat 1-2 Hurricane Tourist Occupancy, Horry County

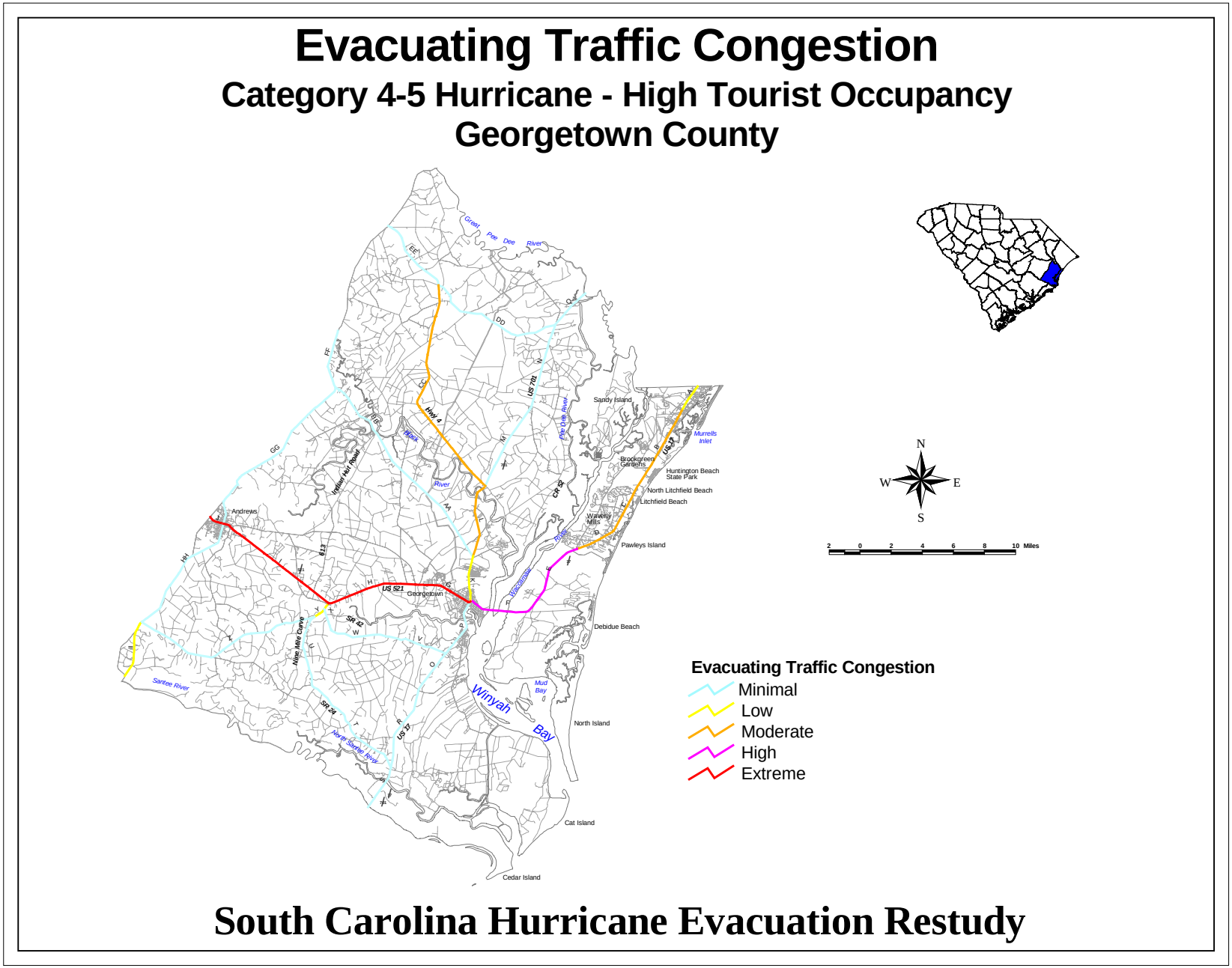


Figure 6-22. Evacuating Traffic Congestion Cat 4-5 Hurricane High Tourist Occupancy, Georgetown County

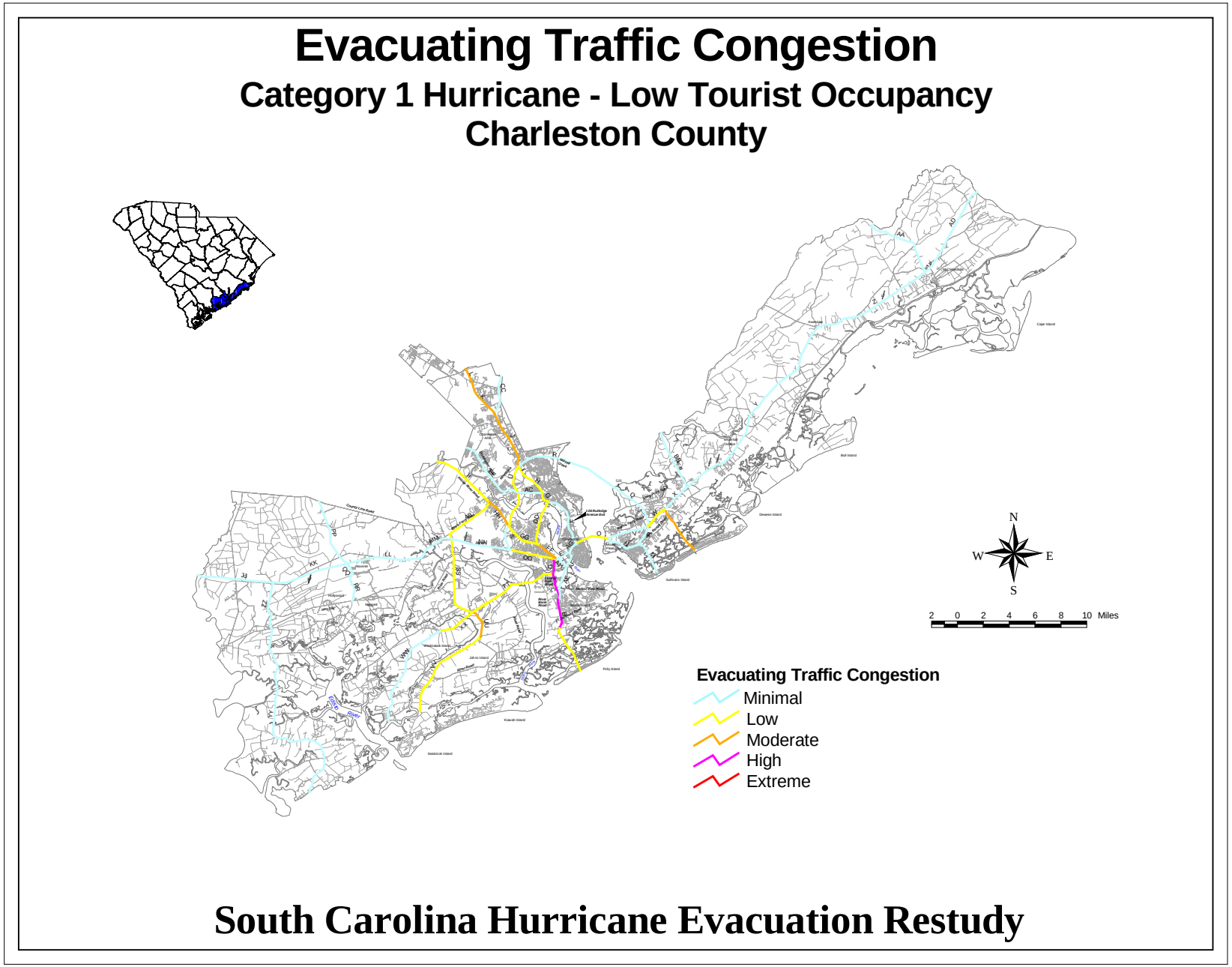


Figure 6-23. Evacuating Traffic Congestion Cat 1 Hurricane Low Tourist Occupancy, Charleston County

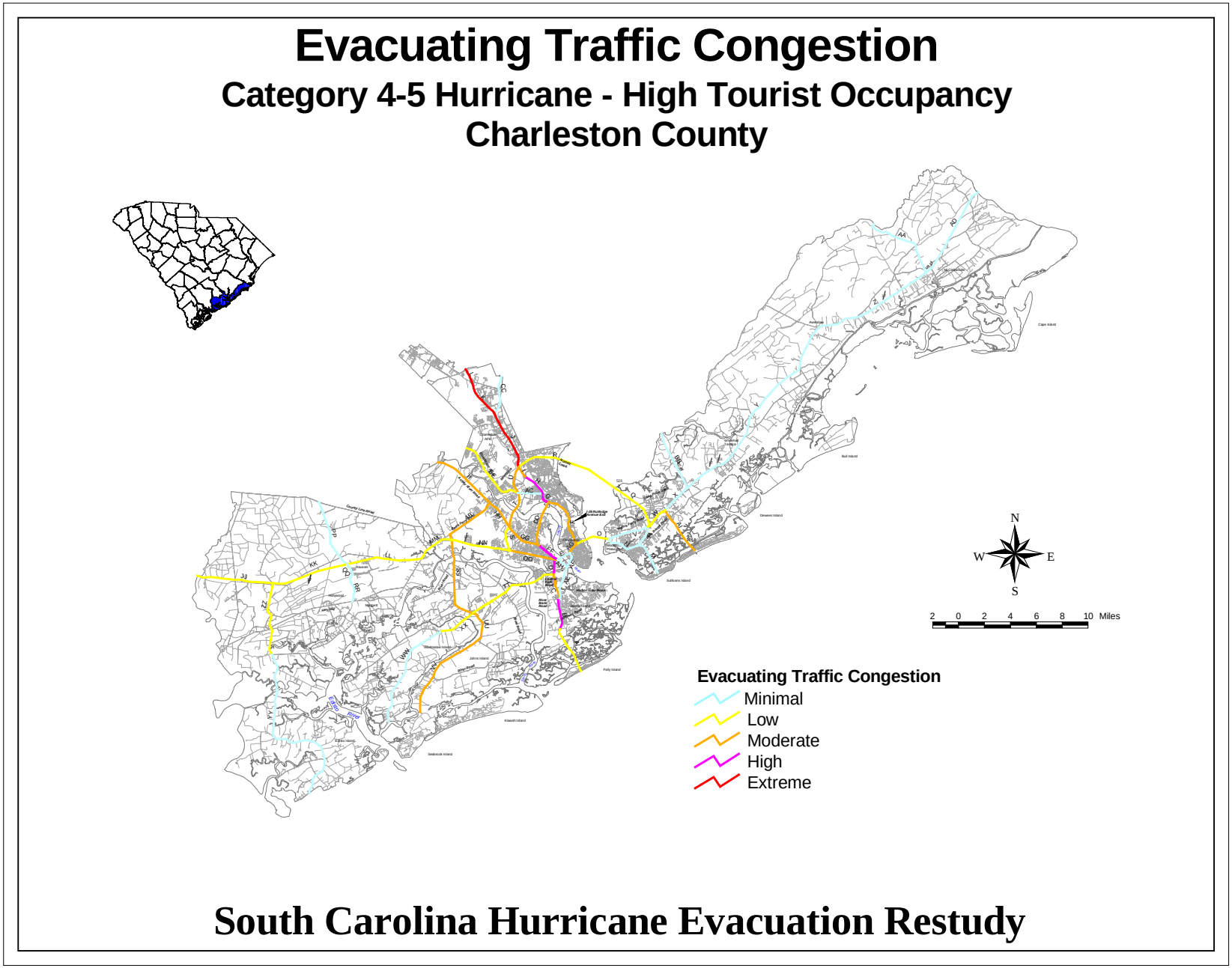


Figure 6-24. Evacuating Traffic Congestion Cat 4-5 Hurricane High Tourist Occupancy, Charleston County

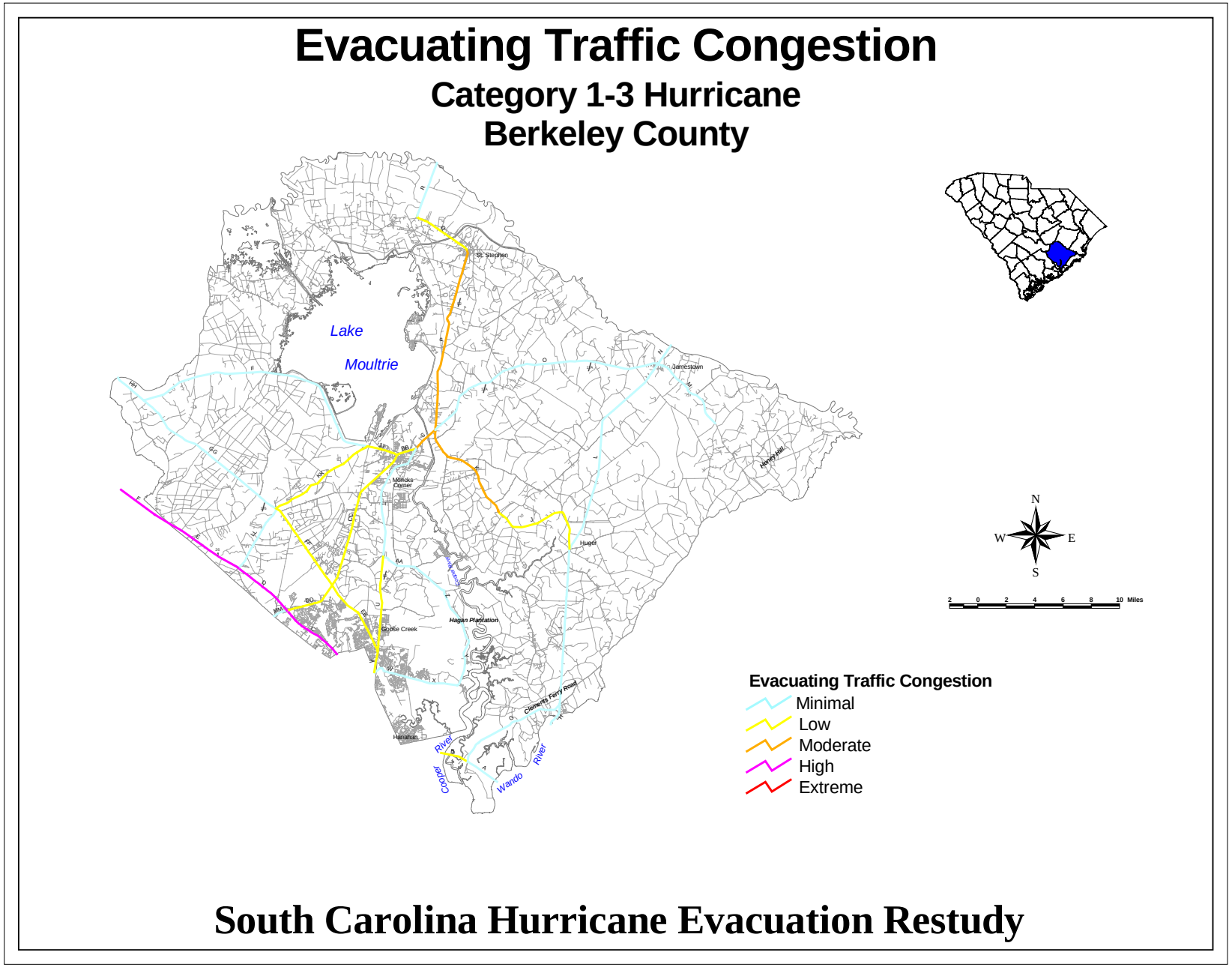


Figure 6-25. Evacuating Traffic Congestion Cat 1-3 Hurricane, Berkeley County

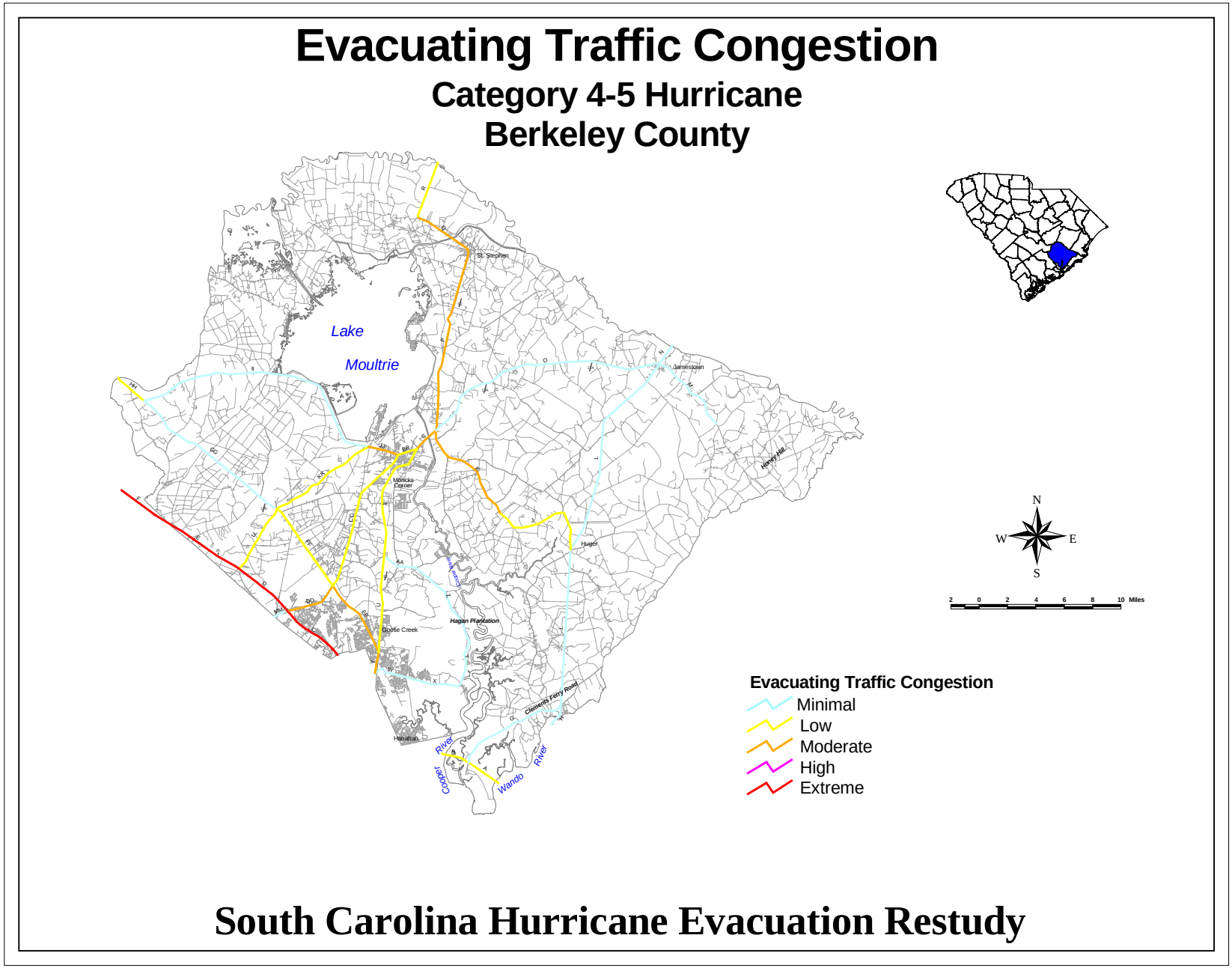


Figure 6-26. Evacuating Traffic Congestion Cat 4-5, Berkeley County

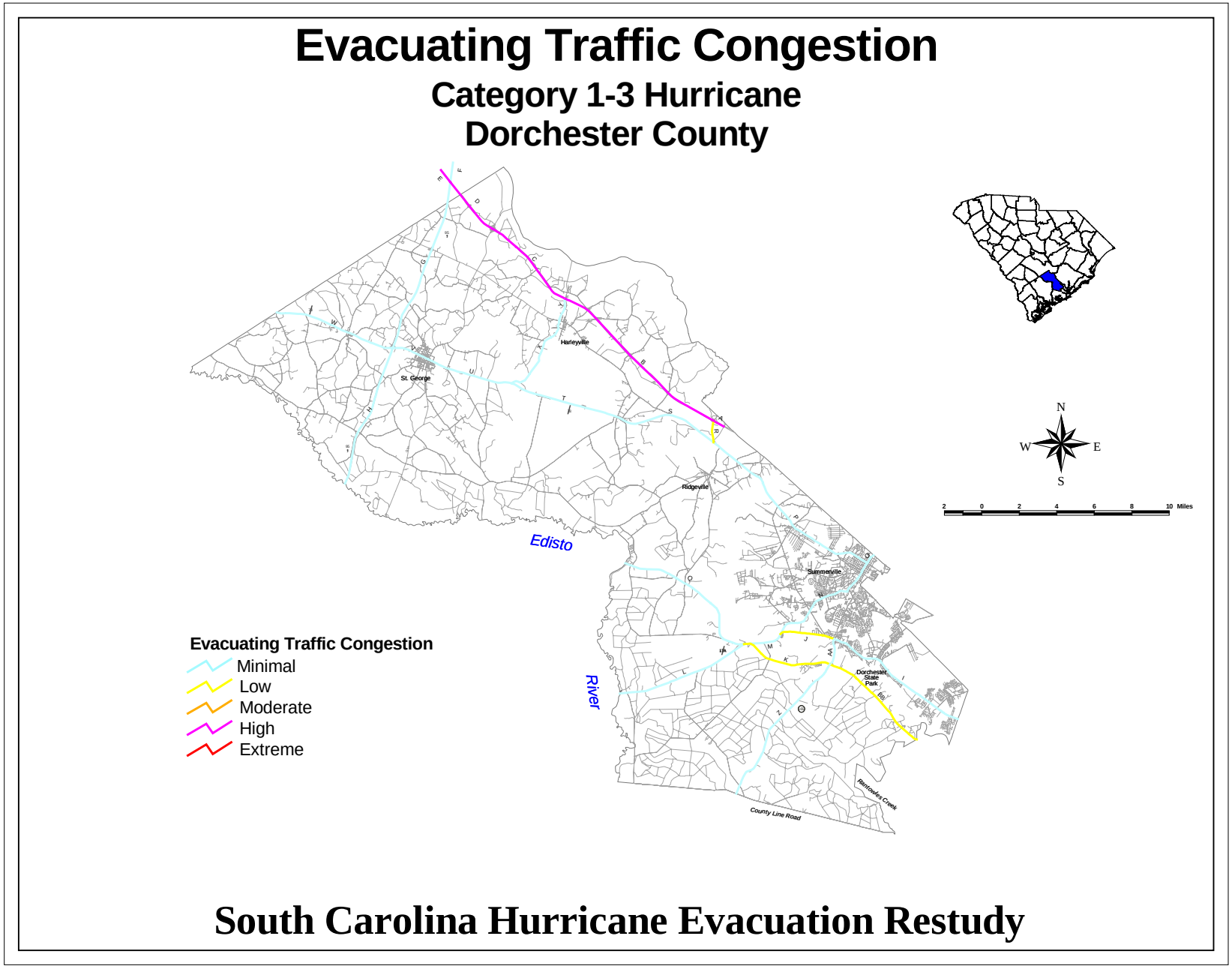


Figure 6-27. Evacuating Traffic Congestion Cat 1-3, Dorchester County

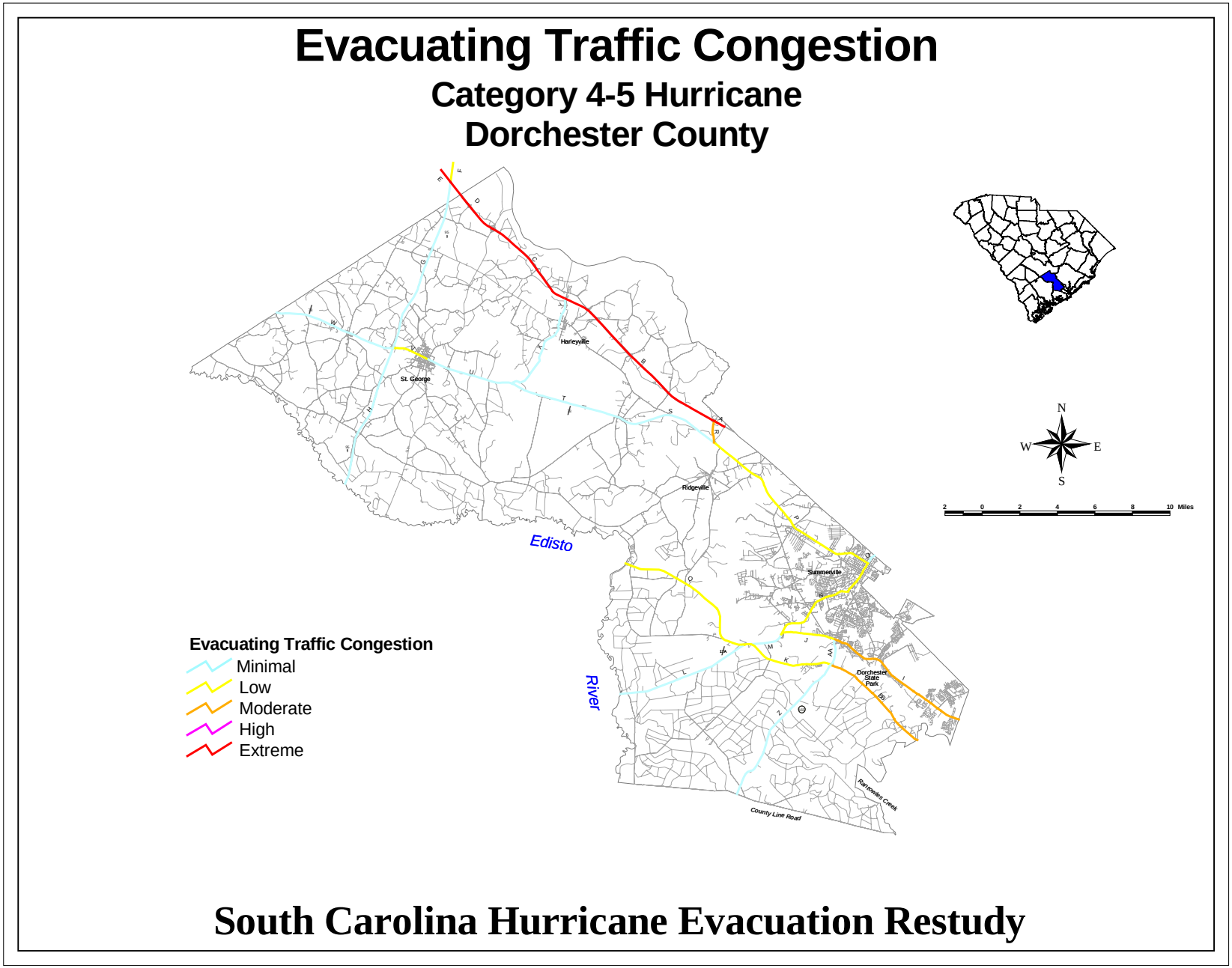


Figure 6-28. Evacuating Traffic Congestion Cat 4-5, Dorchester County

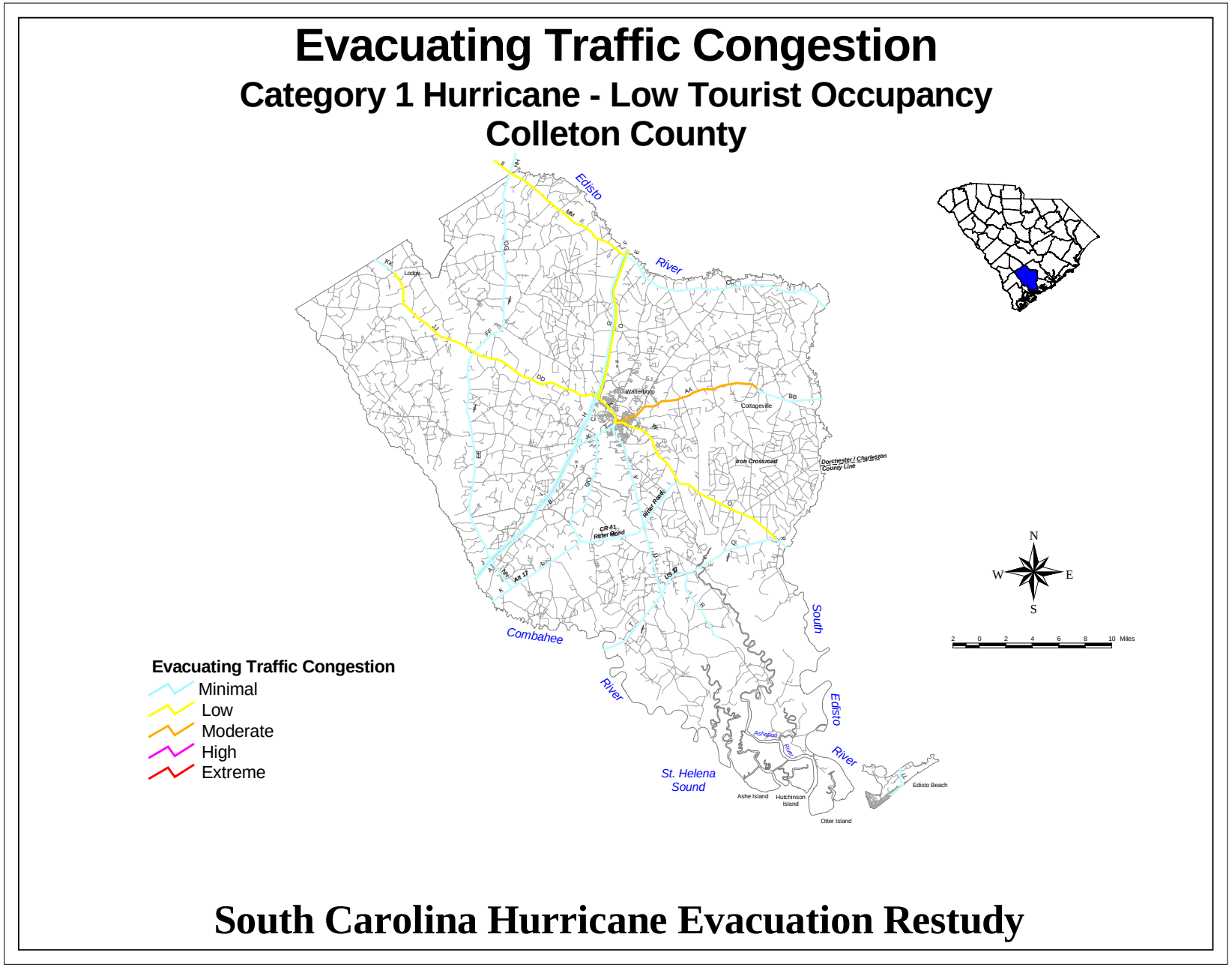


Figure 6-29. Evacuating Traffic Congestion Cat 1 Hurricane Low Tourist Occupancy, Colleton County

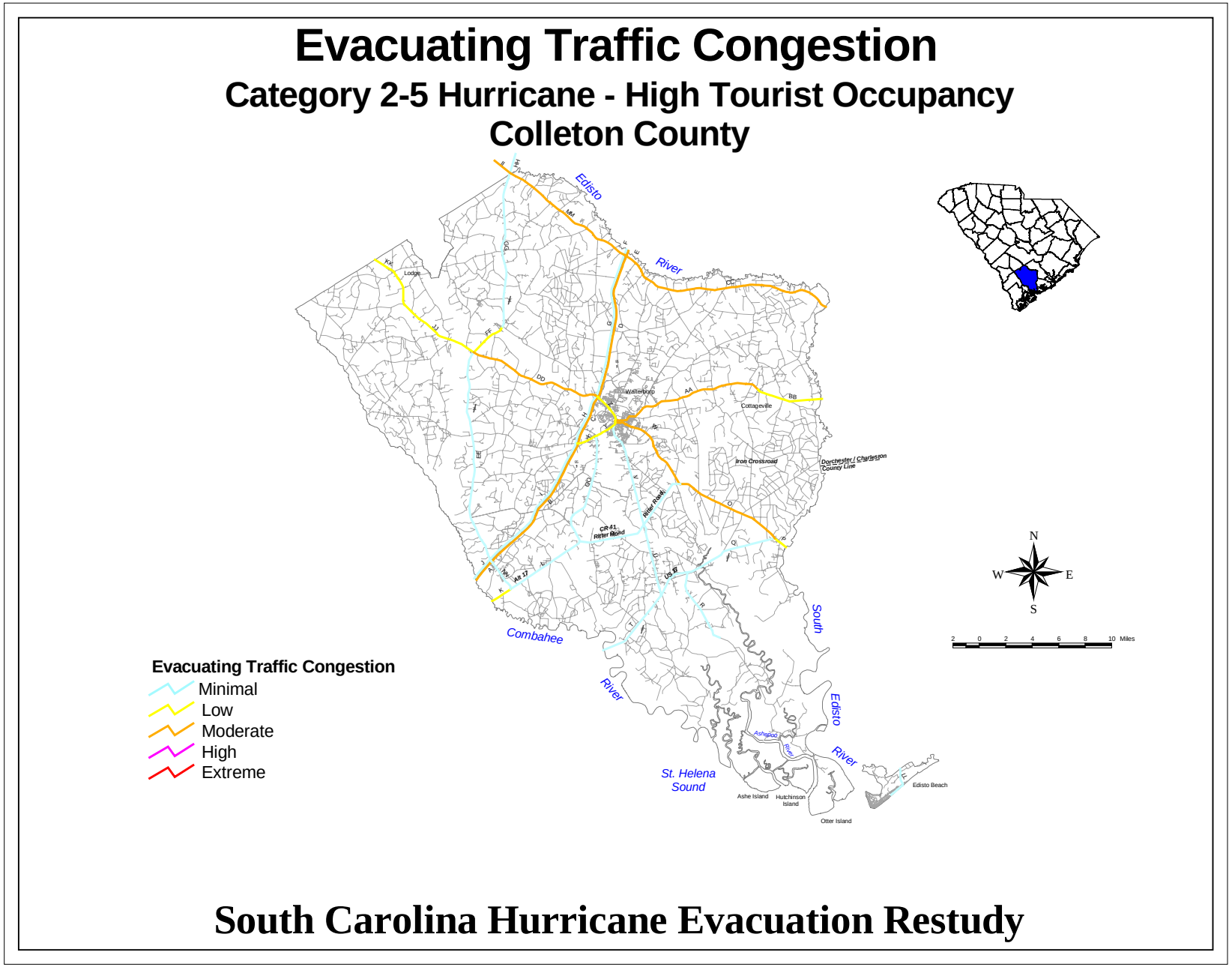


Figure 6-30. Evacuating Traffic Congestion Cat 2-5 Hurricane High Tourist Occupancy, Colleton County

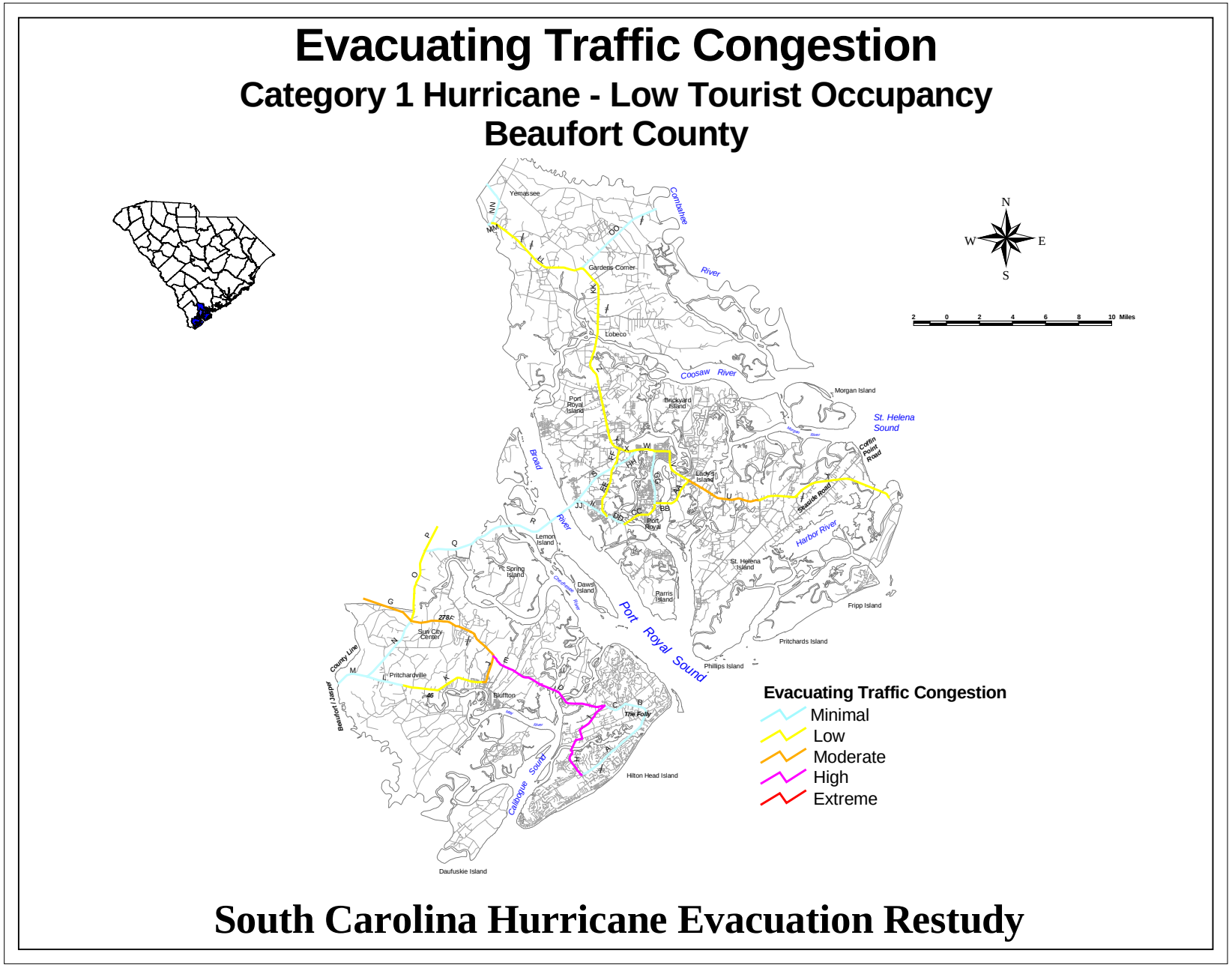
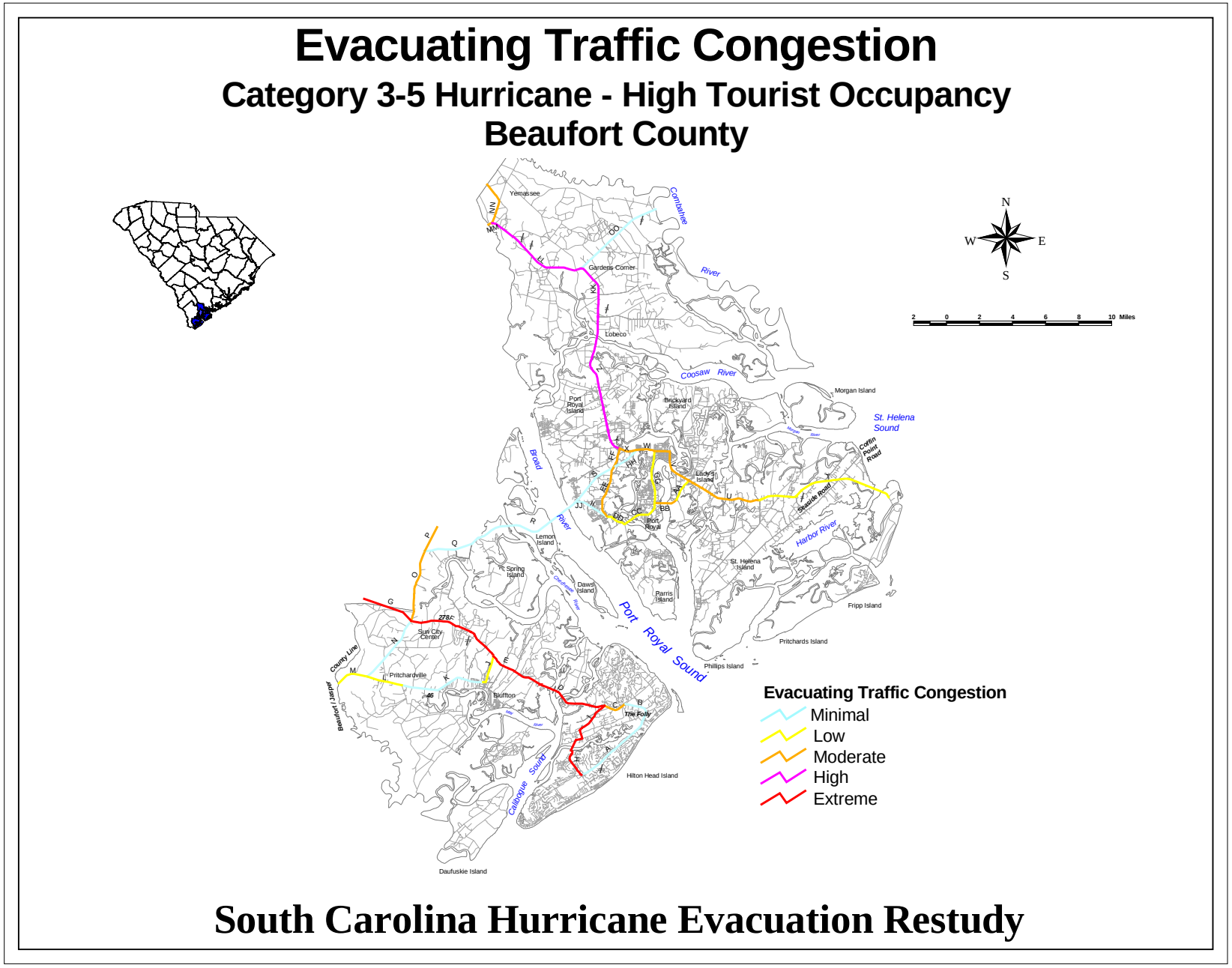


Figure 6-31. Evacuating Traffic Congestion Cat 1 Hurricane Low Tourist Occupancy, Beaufort County



South Carolina Hurricane Evacuation Restudy

Figure 6-32. Evacuating Traffic Congestion Cat 3-5 Hurricane High Tourist Occupancy, Beaufort County

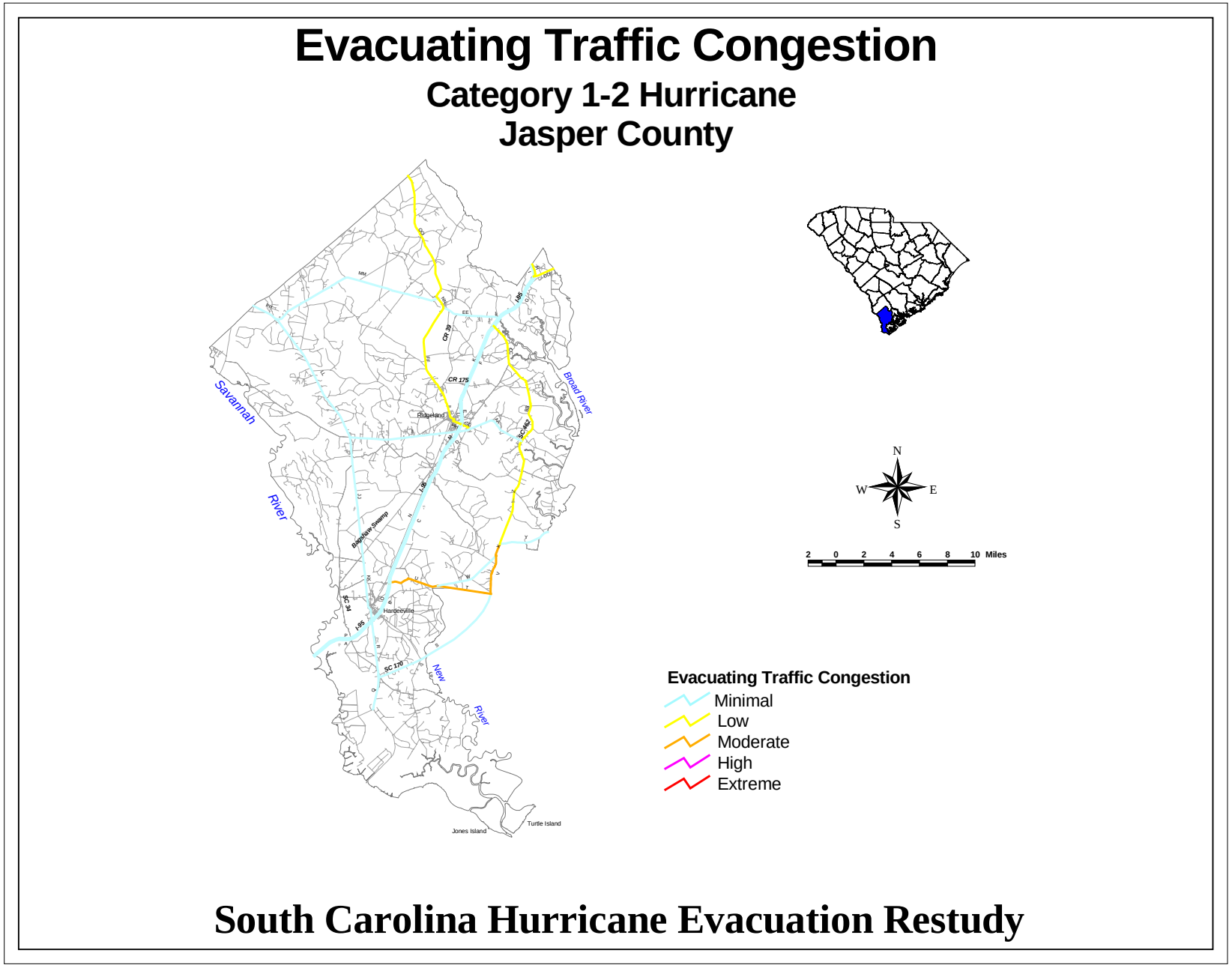


Figure 6-33. Evacuating Traffic Congestion Cat 1-2 Hurricane, Jasper County

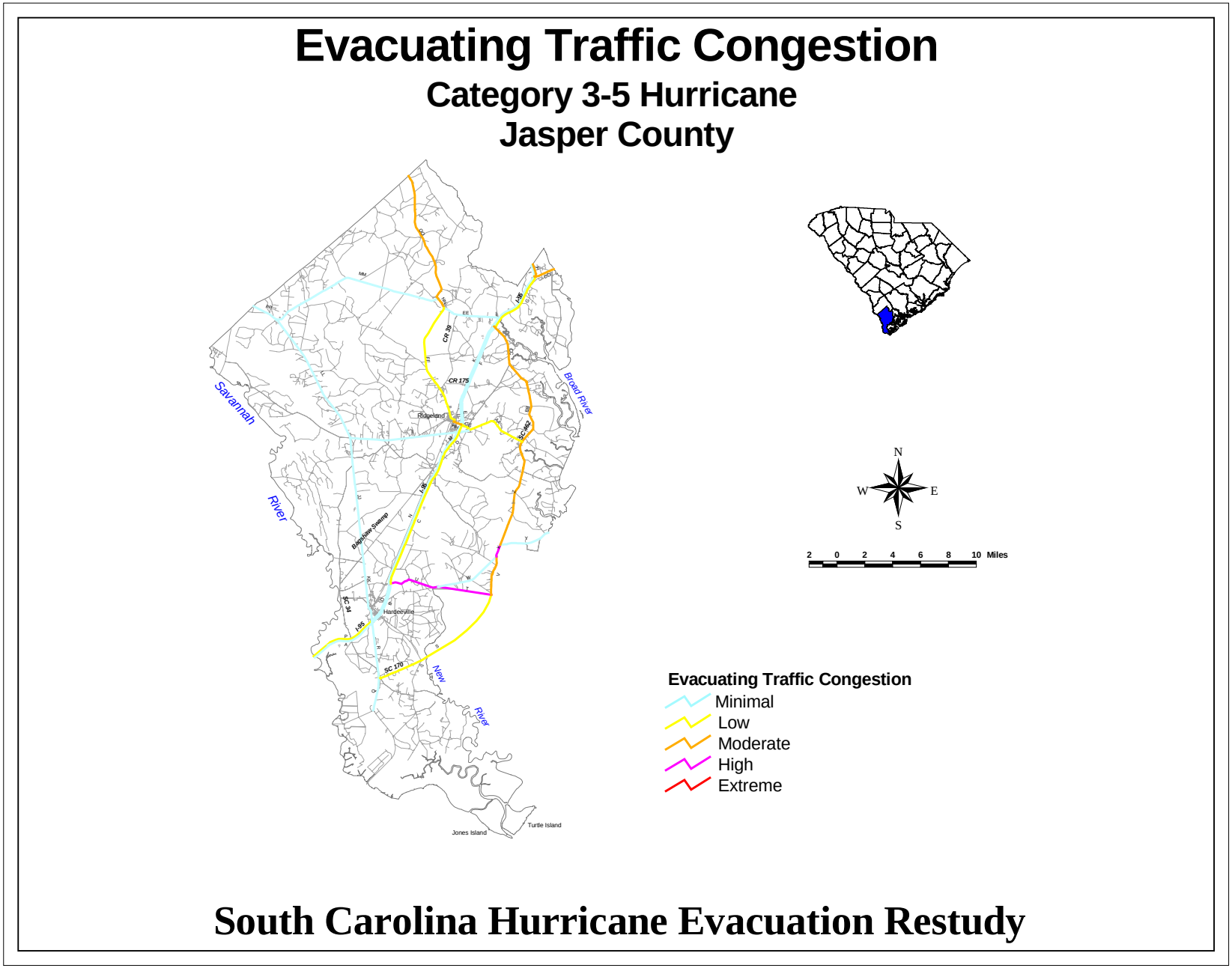
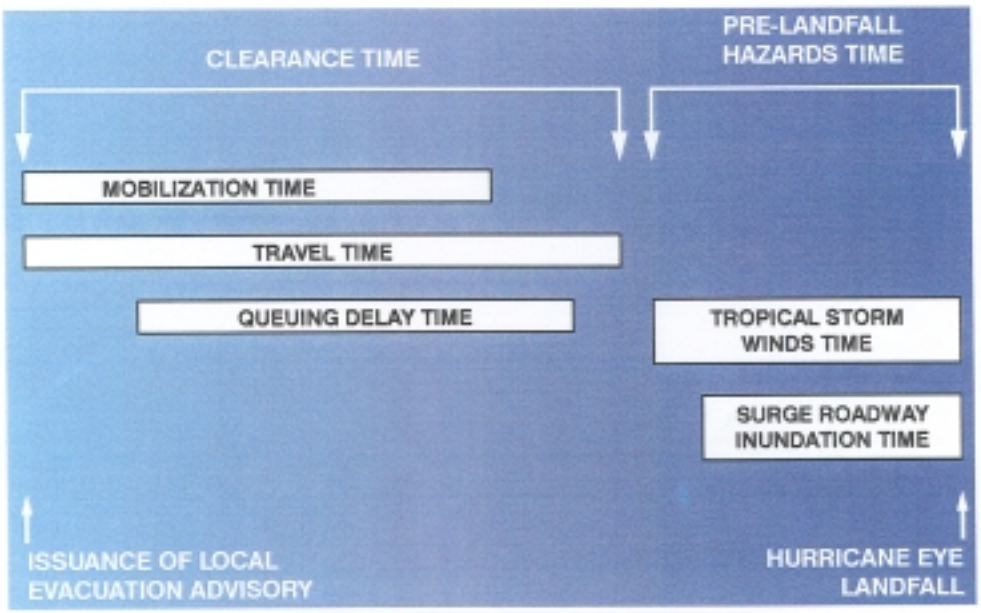


Figure 6-34. Evacuating Traffic Congestion Cat 3-5 Hurricane, Jasper County

6.7.3. Estimated Evacuation Clearance Times

The most important product of the transportation analysis is the clearance times developed by storm scenario and by behavioral characteristic for each conglomerate. Clearance time is one of two major considerations involved in issuing an evacuation order or advisory. The other time aspect which must be weighed is the arrival of sustained tropical storm winds. Figure 6-33 illustrates these two timing issues of evacuation and their relation.

Figure 6-35. Components of Evacuation Time



Clearance time is the time required to clear the roadway of all vehicles evacuating in response to a hurricane situation. Clearance time begins when the first evacuating vehicle enters the road network (as defined by a hurricane evacuation behavioral response curve) and ends when the last evacuating vehicle reaches an assumed point of safety. For the South Carolina study, I-95 was the clearance time cut-off point for the northern and central conglomerates. The Allendale/Hampton County line was the clearance time cut-off point for the Southern Conglomerate. Clearance time includes the time required by evacuees to enter the road network (referred to as mobilization time) and the time spent by evacuees traveling along the road network due to traffic congestion (referred to as queuing delay time). Clearance time does not relate to the time any one vehicle spends traveling on the road network and does not include time needed for local officials to assemble and make a decision to evacuate.

Table 6-3 represents the hurricane evacuation clearance times developed for each conglomerate for the Year 2000 storm scenario. Several hundred clearance time runs were accomplished based on differing intensity of hurricanes, evacuation area assumptions, rapidity of evacuees' response, and differing tourist seasons. Clearance times generally fall below 24 hours for most all of the evacuation scenarios. However, due to the limited road network and large numbers of tourists and permanent residents who would have to evacuate in the northern conglomerate, times could potentially exceed 30 hours for a Category 4-5 hurricane, high tourist occupancy scenario.

Due to the location of the controlling bottlenecks for clearance time calculations in each conglomerate (US Highway 501 out of Myrtle Beach, I-26 out of Charleston, and US Highway 278 off Hilton Head Island) one or more conglomerates' evacuation traffic does nothing to an adjacent conglomerates' clearance time situation. For the southern and northern conglomerates, clearance times are largely a function of how well bottlenecks near the coast are processing evacuation traffic and whether inland traffic control points are manned. For the central conglomerate, the bottleneck controlling time extends further inland (I-26 at I-95) and is influenced by many different sources of evacuation traffic. The clearance evacuation times to be used when one or more conglomerate evacuates is the longest time for each conglomerate based upon their own individual clearance time and the track/forward speed of the storm relative to their area's location. In addition, traffic produced by inland county mobile homes does little to impact congestion levels on inland evacuation routes. Inland traffic assignments reflect the tendency for inland mobile homes to evacuate within the county.

Previous evacuations in South Carolina for Hurricanes Hugo, Bertha, Fran and Floyd confirm these observations and model results. Clearance times reflect the effects of adjacent county traffic impacts in each conglomerate and assume that consistent evacuation decisions will be made and coordinated between adjacent local jurisdictions and directed by state officials.

A new feature of the clearance time calculation module is that of looking at queuing occurring for people leaving at different points throughout an evacuation. Travel times became quite lengthy for evacuees who left in the middle of the Floyd evacuation. This was due to the rapid loading of the highway network and the sheer volume of evacuees participating in response to a potential Category 4-5 hurricane.

For the northern conglomerate, worst household commute times will be 2½ to 6 hours in a Category 1-2 hurricane when there is a low tourist occupancy. For a Category 1-2 hurricane with a high tourist occupancy, these times will be in the 10½ to 14 hours for worst household commute times. The shorter household

commute times result from a longer loading of the highway network, whereas the longest household commute times result from the rapid response/quick loading of the road network. For a Category 5 scenario with a high tourist occupancy, worst household commute times could be as high as 19 to 23 hours. Even with the reverse lane operation on US 501, households leaving during the middle of the evacuation could have an 11 to 15 hour commute.

For the central conglomerate, worst household commute times will be 1½ to 4¾ hours in a Category 1 hurricane where there is low tourist occupancy. For a Category 1 hurricane with a high tourist occupancy, these times will be in the 2 to 6¼ hours for worst household commute times. For a Category 4-5 scenario with high tourist occupancy, worst household commute times could be as high as 13½ to 18 hours. Even with the reverse lane operation on I-26, households leaving during the middle of the evacuation could have a 4 to 8½ hour commute. In light of Floyd data and "stories", these numbers seem to be valid.

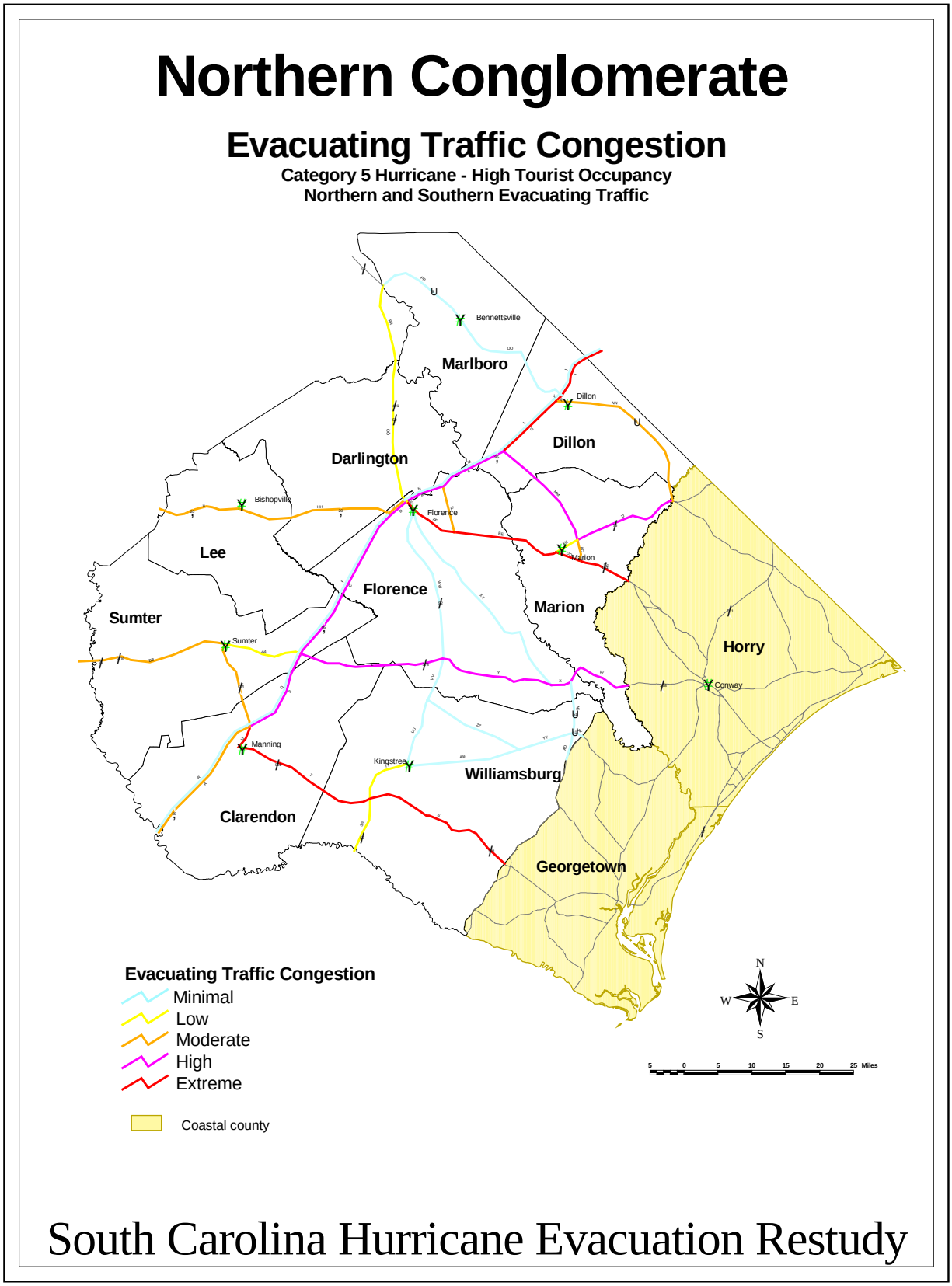


Figure 6-36. Evacuating Traffic Congestion, Northern Conglomerate

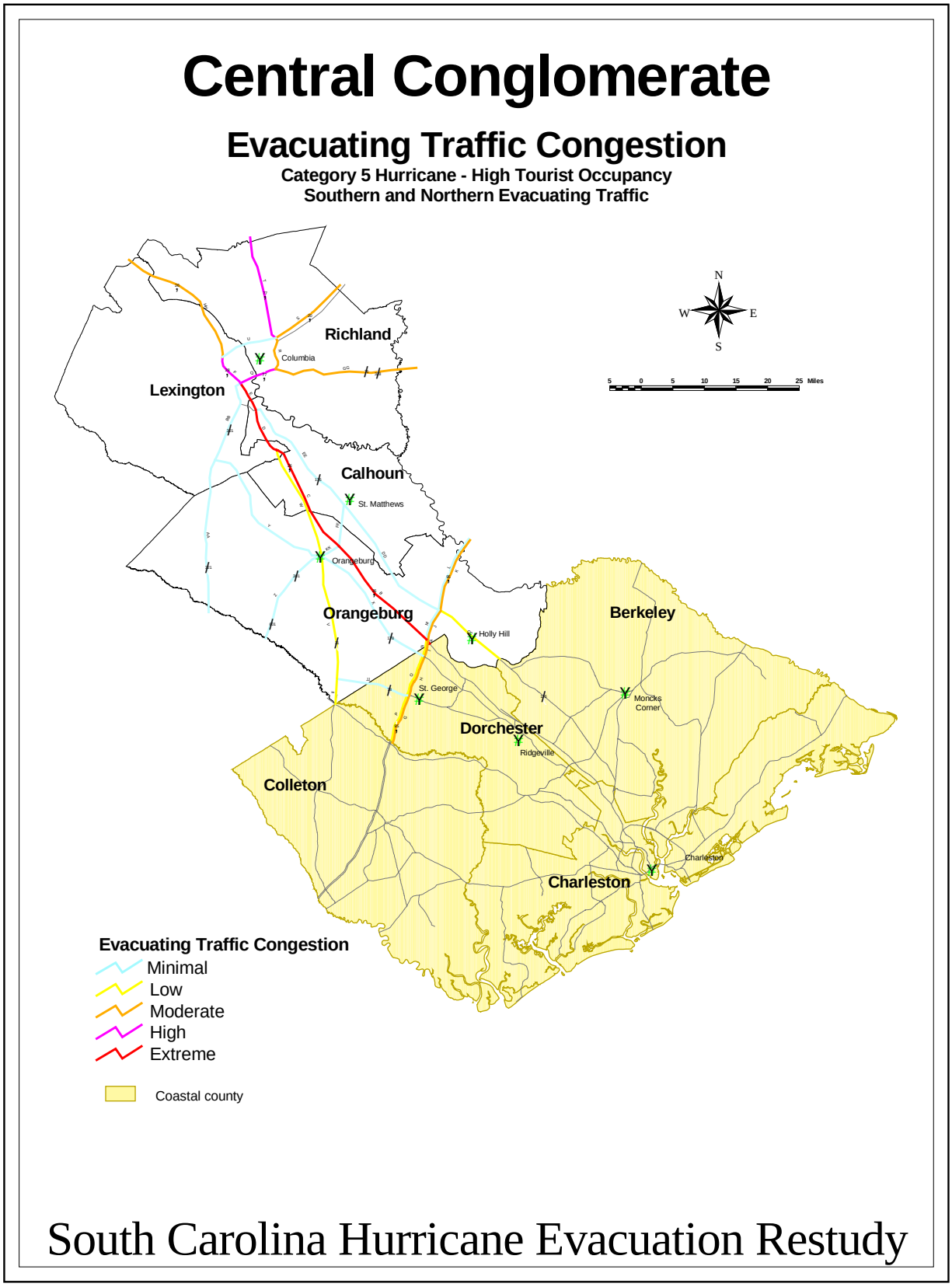


Figure 6-37. Evacuating Traffic Congestion, Central Conglomerate

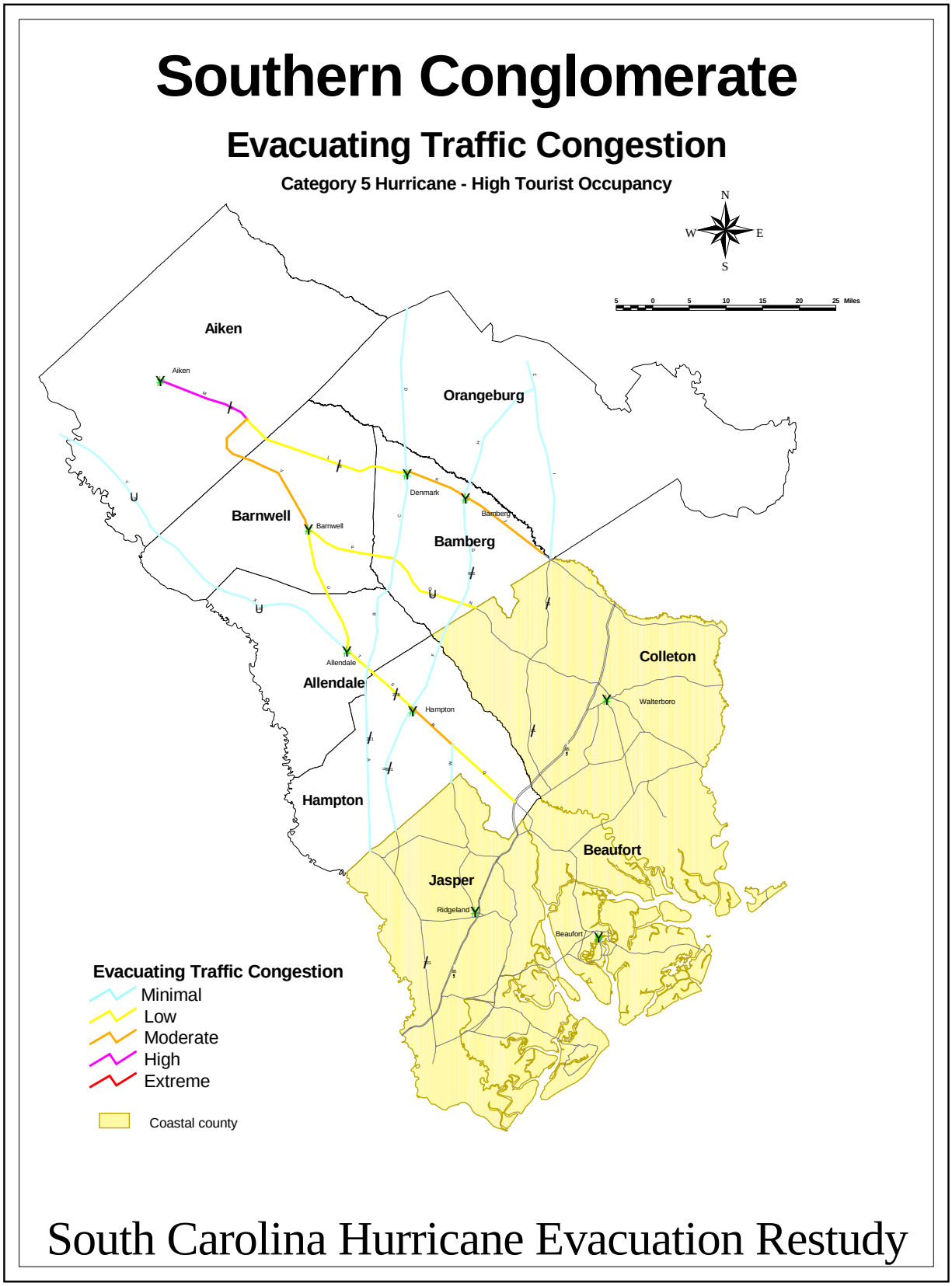


Figure 6-38. Evacuating Traffic Congestion, Southern Conglomerate

Table 6-3
NORTHERN CONGLOMERATE CLEARANCE TIMES (IN HOURS)
South Carolina Hurricane Evacuation Restudy

	Normal Lane Use		W/US 501 Reverse Lane	
	Low Tourist Occupancy	High Tourist Occupancy	Low Tourist Occupancy	High Tourist Occupancy
Category 1-2 Hurricane				
Rapid Response	12.1 hours	20.8 hours	9.1 hours	15.2 hours
Medium Response	12.7	21.7	9.5	16.0
Long Response	13.1	22.1	12.5	16.3
Category 3-4 Hurricane				
Rapid Response	20.6	29.8	15.1	21.7
Medium Response	21.3	30.8	15.7	22.5
Long Response	21.6	31.2	15.9	22.8
Category 5 Hurricane				
Rapid Response	21.1	30.4	15.5	22.1
Medium Response	21.8	31.5	16.1	23.0
Long Response	22.1	31.8	16.2	23.2

Please Note: All times reported in this table have been calculated post-Floyd and reflect preliminary operational procedures and postures that have resulted from planning by the SCEPD, SCDOT, DPS. Observed real time traffic flow figures from recent SC hurricane evacuations have been used for roadway capacity assumptions. The times also reflect evacuation zone systems, scenarios and Year 2000 population estimates finalized by SCEPD and local county emergency management as of September 1, 1999. Individual household travel times are shortest for the long response situation where traffic loading the highways is spread over 11+ hours and is longest for the rapid response situation where all evacuees try to load the highways within 5 hours. Times are calculated under the assumption that all traffic control points listed in the June 1999 Traffic Management/Law Enforcement Northern Coastal Conglomerate Annex to the state hurricane plan, will be manned and actively managed. US 501 reverse lane assumed from US 17 Bypass to Conway.

Table 6-3 (Continued)
CENTRAL CONGLOMERATE CLEARANCE TIMES (IN HOURS)
South Carolina Hurricane Evacuation Restudy

	Normal Lane Use		W/I-26 Reverse Lane	
	Low Tourist Occupancy	High Tourist Occupancy	Low Tourist Occupancy	High Tourist Occupancy
Category 1 Hurricane				
Rapid Response	10.3 hours	11.9 hours	6.2 hours	7.2 hours
Medium Response	10.5	12.2	9.0	9.0
Long Response	12.0	12.3	12.0	12.0
Category 2 Hurricane				
Rapid Response	14.3	16.7	8.5	9.9
Medium Response	14.6	17.0	9.0	10.1
Long Response	14.7	17.1	12.0	12.0
Category 3 Hurricane				
Rapid Response	18.8	21.8	11.1	12.8
Medium Response	19.2	22.2	11.3	13.0
Long Response	19.3	22.3	11.4	13.1
Category 4-5 Hurricane				
Rapid Response	21.8	24.5	12.8	14.2
Medium Response	22.2	24.8	13.0	14.5
Long Response	22.3	24.9	13.1	14.6

Please Note: All times reported in this table have been calculated post-Floyd and reflect preliminary operational procedures and postures that have resulted from planning by the SCEPD, SCDOT, DPS. Observed real time traffic flow figures from recent SC hurricane evacuations have been used for roadway capacity assumptions. The times also reflect evacuation zone systems, scenarios and Year 2000 population estimates finalized by SCEPD and local county emergency management as of September 1, 1999. Individual household travel times are shortest for the long response situation where traffic loading the highways is spread over 11+ hours and is longest for the rapid response situation where all evacuees try to load the highways within 5 hours. For reverse lane scenarios, times assume traffic separation at the Mark Clark Expressway/I-26 interchange and aggressive traffic control on Folly road south of the James Island Bridge connector. It is also assumed that the reverse lanes will be implemented up to I-77 near Columbia. Times are calculated under the assumption that all traffic control points listed in the June 1999 Traffic Management/Law Enforcement Central Coastal Conglomerate Annex to the state hurricane plan, will be manned and actively managed.

Table 6-3 (Continued)
SOUTHERN CONGLOMERATE CLEARANCE TIMES (IN HOURS)
South Carolina Hurricane Evacuation Restudy

	Normal Lane Use		W/US 278 Reverse Lane	
	Low Tourist Occupancy	High Tourist Occupancy	Low Tourist Occupancy	High Tourist Occupancy
Category 1 Hurricane				
Rapid Response	10.9 hours	16.3 hours	8.7 hours	12.9 hours
Medium Response	11.5	17.3	9.3	13.9
Long Response	12.0	18.1	12.0	14.5
Category 2 Hurricane				
Rapid Response	12.9	18.7	10.3	14.8
Medium Response	13.5	19.7	10.8	15.8
Long Response	13.9	20.5	12.0	16.3
Category 3-5 Hurricane				
Rapid Response	14.2	20.0	11.3	15.8
Medium Response	14.8	21.1	11.9	16.8
Long Response	15.2	21.8	12.2	17.4

Please Note: All times reported in this table have been calculated post-Floyd and reflect preliminary operational procedures and postures that have resulted from planning by the SCEPD, SCDOT, DPS. Observed real time traffic flow figures from recent SC hurricane evacuations have been used for roadway capacity assumptions. The times also reflect evacuation zone systems, scenarios and Year 2000 population estimates finalized by SCEPD and local county emergency management as of September 1, 1999. Individual household travel times are shortest for the long response situation where traffic loading the highways is spread over 11+ hours and is longest for the rapid response situation where all evacuees try to load the highways within 5 hours. Times are calculated under the assumption that all traffic control points listed in the June 1999 Traffic Management/Law Enforcement Southern Coastal Conglomerate Annex to the state hurricane plan, will be manned and actively managed. US 278 reverse lane assumed from island connector to Burnt Church Road.

6.8 TRAFFIC CONTROL MEASURES

Some general recommendations concerning traffic control are as follows:

- Staff TCP's (Traffic Control Points) per state annex regarding traffic management as personnel resources permit - focus at a minimum on critical roadway locations identified in the restudy which will control the overall clearance times in each conglomerate.

Northern Conglomerate

- Strongly encourage residents north of the juncture of US 17 Bypass and US 17 (north of Myrtle Beach) to use SC 9 for their out-of-county evacuation route. Likewise, strongly encourage residents of Surfside Beach and Garden City to go south through Georgetown County.

- Using law enforcement personnel or preemptive signal timing patterns, keep evacuation traffic flowing westbound (as continuously as possible) on US 501 between 17 Bypass and Conway.

- Encourage Socastee and surrounding area evacuees to use SC 544 and SC 319 to help with congestion (near the coast) on US 501 - address reconnection of traffic at Aynor where the routes come back together.

- Average travel speeds on US 501 east of Conway should be monitored during an evacuation and when speeds drop to the 15 to 25 mph range for at least an hour, a third evacuation lane should be implemented based on SCDOT and DPS planning.

Central Conglomerate

- The state EPD and local Charleston area emergency preparedness officials have three basic strategies that can be used to deal with a future "Floyd" type storm and response. First, the more traffic loading of the highways is spread out over time, the less congestion individual evacuees will experience. To spread the travel demand over a longer period, officials might consider issuing a voluntary evacuation order at least ten to twelve hours before a mandatory order (if the behavior and meteorology of the storm allows). Phasing of the evacuation by telling barrier island residents to leave first could also help but probably would be somewhat ineffective in a Category 4/5 hurricane bearing down directly on the Charleston area as concerned residents would desire to get out of harm's way as quickly as possible, regardless of their location in the

county. Certainly, the manner in which information is provided to the public through the Weather Channel, local TV stations, radio and print media will have a great effect on the success or failure of phased evacuations.

- The second strategy would be to monitor traffic congestion levels (by observing average travel speeds on I-26 and alternate evacuation routes) and as conditions on I-26 warrant, encourage evacuees just beginning their evacuation movements to consider using US 52, US 176, US 78, and SC 61. As conditions improve or deteriorate on specific routes, that information could be shared with the public via radio and/or variable message signs. Perhaps the observance of average travel speeds of 30-40 mph on I-26 over at least an hour's duration could trigger this strategy.

- The third strategy (the reverse laning of I-26 from the Mark Clark Expressway in Charleston to I-77 in Columbia) should only be implemented if the first two are unsuccessful. With the public's and politician's sensitivities to the Floyd evacuation experience, there will be considerable pressure to implement this strategy early in the evacuation process. Due to the complexities, safety concerns and resources required for the highway patrol and DOT to implement this third strategy, it should be used only in the most severe storm scenarios. Just as the second strategy, the implementation should be triggered by actual congestion levels on I-26. The observance of average travel speeds of 15 to 25 mph on I-26 over at least an hour's duration could be used as a threshold for this action. However, resource positioning would need to take place well before these congestion levels are seen.

- Monitor high level bridges for early wind hazards and prohibit high profile vehicles at some agreed upon wind benchmark.

<u>Southern Conglomerate</u>

- Encourage Fripp Island and St. Helena to use SC 802/SC 280 to bypass expected congestion in Beaufort on US 21.

- For Category 4-5 hurricane where there is a high occupancy of seasonal units on Hilton Head and where a rapid response is required on the part of the evacuating population due to changes in the meteorology of a storm (increase in forward speed, increase in intensity, etc.), state EPD, DOT, highway patrol and the local county should implement a third westbound evacuation lane between the Cross Island Parkway and Burnt Church Road to separate out evacuees who want to go south on I-95 and who are willing to use SC 46.

- Coordinate with GEMA and Chatham County emergency management regarding expected flows of SC evacuees to I-16 westbound.

- Arrange agreements with tow truck operators so that they are pre-positioned along key travel corridors and critical roadway locations.

- Work with the US Coast Guard on arranging for draw/swing bridges to be locked down during a hurricane warning, if possible.

For the southern conglomerate, worst household commute times will be 1¾ to 5½ hours in a Category 1 hurricane when there is a low tourist occupancy. For a Category 1 hurricane with a high tourist occupancy, these times will be in the 7½ to 10½ hours for worst household commute times. Again, the shorter household commute times result from a longer loading of the highway network, whereas, the longest household commute times result from the rapid response/quick loading of the road network. For a Category 3-5 scenario with a high tourist occupancy, worst household commute times could be as high as 10¾ to 14 hours. Even with the reverse lane operation on US 278, households leaving during the middle of the evacuation could have a 6¾ to 10 hour commute.

CHAPTER SEVEN - DECISION TOOLS

7.1 PURPOSE

This chapter describes the decision tools developed by FEMA and the USACE for hurricane evacuation planning and decision making. Presently two decision tools have been developed; the Decision Arc Method, and HURREVAC. The Decision Arc Method is a manual hurricane evacuation planning and decision-making tool that uses clearance times in conjunction with National Hurricane Center advisories to help determine when and if evacuations should begin. HURREVAC is a computer software program that automates many of the manual processes of the decision arc method and adds additional user functionality.

7.2 BACKGROUND

Hurricanes do not always approach land from a direction perpendicular to the coastline and frequently enter the mainland on an angular track. When a hurricane is still 24 hours off the coast an error of 10 degrees in predicting the hurricane track can easily mean a 100-mile difference in the point of landfall. The average error of landfall positions in a 12-hour forecast is roughly 50-60 miles.

When a hurricane approaches a coastline at an acute angle, an error in forecast landfall position will increase or decrease the distance to landfall, possibly resulting in a significant error in forecast time of landfall. The forward motion of hurricanes can also accelerate and decelerate, causing the time of landfall to be even more unpredictable. Since hurricane evacuation decision-making and mobilization have typically been dependent upon forecast landfall position and time of landfall, a method was needed that would help compensate for forecast errors by relating evacuation operations to hurricane position.

It is strongly recommended that hurricane vulnerable jurisdictions investigate the various hurricane evacuation decision-making computer programs (HURREVAC) in use today. These programs incorporate the latest hurricane evacuation study data, including some form of the Decision Arc Method presented in this chapter. Computer assistance can be very useful in speeding needed calculations and displaying important information and relationships. Even if a computer program is used, emergency management officials should be familiar with the concepts presented in this chapter. This will promote

confidence in the software and ensure that decision-making can proceed despite power outages or computer failure.

7.3 DECISION ARC EQUIPMENT

The Decision Arc Method employs two separate but related components which, when used together, present a graphic depiction of the hurricane situation. A specialized hurricane tracking chart called the Decision Arc Map, is teamed with a transparent two-dimensional hurricane graphic called the STORM, to describe the approaching hurricane and its relation to the area considering evacuation.

7.3.1. Decision Arc Map

In order to properly evaluate the last reported position and forecast track of an approaching hurricane, a special hurricane tracking chart has been developed for the study area. Superimposed on an ordinary tracking chart is a series of concentric arcs centered on the southernmost boundary of the study area and spaced at 20-nautical-mile intervals. These arcs are labeled alphabetically and in nautical miles measured from their center. Figure 7-1 through 7-3 included at the end of this Chapter are Decision Arc Maps for each county in the study area. These maps can be used as is with the transparent STORM Tool described below for real-time decision arc determination.

7.3.2. STORM Tool

The Special Tool for Observing Range and Motion (STORM) is used as a two-dimensional depiction of an approaching hurricane. It is a transparent overlay with concentric circles spaced at 25-nautical-mile intervals, their center representing the hurricane eye. These circles form a scale used to note the radii of 34-knot (Gale force) winds reported by the National Hurricane Center in the Marine Advisory. Figure 7-4 included at the end of this Chapter is the STORM tool. This tool can be used with Figures 7-1 through 7-3 for real-time decision arc determination.

7.3.3. National Hurricane Center Tropical Cyclone Advisory

Marine advisories on tropical storms are normally issued by the National Hurricane Center every 6 hours: 0500EDT, 1100EDT, 1700EDT, and 2300EDT. At times, supplementary intermediate advisories are also issued. These advisories contain information on present and forecast position, intensity, size, and movement that is used in the Decision Arc Method.

7.4 DECISION ARC CONCEPT

A hurricane evacuation should be completed prior to the arrival of sustained 34-knot (Gale force) winds or the onset of storm surge inundation, whichever occurs first. Along the South Carolina coast, the limiting factor for hurricane evacuation is primarily the arrival of sustained 34-knot winds.
The clearance time is the time required to clear the roadways of all evacuating vehicles. It therefore determines the minimum time period, in hours prior to the arrival of sustained 34-knot winds, necessary for a safe evacuation. Clearance times are based on three variables: (1) the Saffir/Simpson hurricane category, (2) the expected evacuee response rate, and (3) the tourist occupancy situation (where applicable).

Decision Arcs are clearance times converted to distance by accounting for the forward speed of the hurricane. To translate a clearance time into nautical miles (a Decision Arc distance) for use with the Decision Arc Map, a simple calculation of multiplying the clearance time by the forward speed of the hurricane in knots is necessary. This calculation yields the distance in nautical miles that the 34-knot wind field will move while the evacuation is underway.

7.4.1. Should Evacuation be Recommended

Probability values shown in the National Hurricane Center's (NHC) Probability Advisory describe in percentages the chance that the center of a storm will pass within 65 miles of the listed locations. The maximum probability the NHC uses for predicting a direct hit varies with the length of time before landfall. Table 7-1 shows these maximums. The total probability value for your location, shown on the right side of the Marine Advisory probabilities table, should be compared to other locations and to the maximums shown in table 7-1. This will indicate the relative vulnerability of your location as compared with adjacent locations and with the maximum possible probability.

Table 7-1 Maximum Probability Values by Forecast Period

Forecast period Hours	72	60	48	42	36	30	24	18	12
Maximum probability %	10	11	13	16	20	27	35	45	60

7.4.2. When Evacuation Should Begin

As a hurricane approaches, the Decision Arc Method requires officials to make an evacuation decision prior to the time at which the radius of sustained 34-knot winds touches the appropriate Decision Arc (the Decision Point). For example, with a clearance time of 15 hours, and a hurricane forward speed of 10 knots, the evacuation should be initiated before the sustained 34-knot winds get within 150 nautical miles (15 hours x 10 knots = 150 nautical miles) of the area being evacuated. This would correspond to Arc "F" on the decision arc map. For convenience, a Decision Arc Table (Table 7-2) has been developed that converts an array of clearance times and forward speeds to respective Decision Arcs. Once the sustained 34-knot winds move across the Decision Arc, there may not be sufficient time to safely evacuate the vulnerable population.

7.5 DECISION ARC PROCEDURE

The following procedure has been developed to assist emergency managers in determining, WHEN an evacuation decision must be made and IF you should initiate an evacuation. The National Hurricane Center Tropical Cyclone Advisory is used to assist in this decision-making process. All notes and cautions shown in this procedure should be heeded as appropriate.

There are four basic "tools" you will need in your evacuation decision procedure:

(1) Decision Arc Map (Figures 7-1 through 7-3)
(2) Decision Arc table (Table 7-2)
(3) Transparent STORM Tool (Figure 7-4)
(4) The NHC Tropical Cyclone Advisory.

STEPS:

1. From the NHC Tropical Cyclone Advisory, plot the last reported position of the hurricane eye on the Decision Arc Map. Note position with date/time. ZULU time (Greenwich mean time) used in the advisory should be converted to eastern daylight time by subtracting four (4) hours. Plot and note the five forecast positions of the hurricane given in the advisory (ie, 12 hr, 24 hr, 36 hr, 48 hr, 72 hr).

2. From the Tropical Cyclone Advisory, note the maximum radius of 34-knot winds (observed or forecast), the maximum sustained wind speed (observed or forecast),

and the current forward speed. Plot the maximum radius of 34-knot winds onto the STORM Tool. See note a. for information on nautical miles/knots.

3. Determine the forecast forward speed of the hurricane in knots. The forecast speed of the hurricane can be determined for each forecast position by dividing the distance between each position by the time interval between each position. Compare these forecast forward speeds to the current forward speed noted in previous advisories. A forecast speed greater than the current or previous forward speed indicates that the hurricane is expected to accelerate, which reduces the time available to the decision-maker.

4. Using the maximum sustained wind speed, determine the category of the approaching hurricane based on the Saffir/Simpson Hurricane Scale. NOTE: Because of potential forecast and SLOSH model inaccuracies, it may be wise to add one category to the forecast landfall intensity.

5. From the clearance time tables in Chapter 6, select the pertinent clearance time. Using that clearance time and the appropriate forecast forward speed of the storm select the appropriate Decision Arc from the Decision Arc Table (Table 7-2). Mark this arc on the Decision Arc Map.

6. Using the center of the STORM Tool as the hurricane eye, locate the STORM on the Decision Arc Map at the last reported hurricane position. Determine if the radius of 34-knot winds falls within the selected Decision Arc (the point at which the radius of 34-knot winds crosses into the selected Decision Arc). If so, available traffic control measures should be implemented and public advisories issued in order to ensure a rapid public response and completion of the evacuation prior to the arrival of sustained 34-knot winds (or no evacuation advisory is issued). See note b. for additional evacuation timing information.

7. Move the STORM to the first forecast position. Determine if the radius of 34-knot winds has passed the Decision Point. If so, the Decision Point will be reached prior to the hurricane eye reaching the first forecast position.

8. If the radius of 34-knot winds has not crossed the decision arc you can estimate the hours remaining before a decision must be made by dividing the number of nautical miles between the current radius of 34-knot winds and the Decision Point by the forward speed used for the Decision Arc table. Determine if the next NHC Tropical Cyclone Advisory will be received prior to the Decision Point.

9. Compare probabilities shown in the Tropical Cyclone Advisory to determine where an evacuation is likely to take place (see note c.). Determine how an evacuation of your jurisdiction would affect the readiness of others and when they

should be notified of your evacuation. Check inundation maps to determine where flooding may occur and evacuation zone maps for zones that should prepare to evacuate.

10. At the Decision Point, evacuation decision-makers should compare the latest probabilities for their location with those for surrounding areas and the maximums shown in table 7-1. In addition to that forecast track information, they should also consider the storm's intensity and the potential inundation.

11. Steps 1 through 10 should be repeated after each NHC advisory until an evacuation decision is made or the hurricane threat has passed.

NOTES

a) Because information given in the Tropical Cyclone Advisory is in nautical miles and knots, the scale of the Decision Arc Maps and STORM is nautical miles. When utilizing hurricane information from sources other than the Marine Advisory, care should be taken to ensure that distances are given in or converted to nautical miles and speeds to knots. Statute miles can be converted to nautical miles by dividing the statute miles value by 1.15. Similarly, miles per hour can be converted to knots by dividing the miles per hour value by 1.15.

b) In the Decision Arc Method, there is no time specifically allocated for evacuation decision-making or mobilizing support personnel. Hurricane readiness operations should progress so that, if evacuation becomes necessary, preparations will be complete and the recommendation to evacuate can be given at the Decision Point.

c) Probability values shown in the Marine Advisory describe in percentages the chance that the center of a storm will pass within 65 miles of the listed locations. To check the relative probability for your particular area, the total probability value for the closest location, shown on the right side of the probability table in the advisory, should be compared to other locations. A comparison should also be made with the possible maximums for the applicable forecast period shown in the table of maximum probability values included in these instructions. These comparisons will show the relative vulnerability of your location to adjacent locations and to the maximum possible probability.

Table 7-2 Decision Arc Table

DECISION ARCS [1]							
ESTIMATED CLEARANCE TIME (HRS.)	FORECAST HURRICANE FORWARD SPEED (KNOTS) [3]						
	5	10	15	20	25	30	35
	DECISION ARC [4]						
5	A	B	C	D	E	F	G
6	A	B	D	E	F	G	H
7	A	C	D	F	G	H	J
8	B	C	E	F	H	J	L
9	B	D	E	G	I	K	M
10	B	D	F	H	J	L	N
11	B	D	G	I	K	M	P
12	B	E	G	J	L	N	Q
13	C	E	H	K	M	P	R
14	C	F	H	K	N	Q	T
15	C	F	I	L	O	R	U
16	C	F	J	M	P	S	V
17	C	G	J	N	Q	T	X
18	D	G	K	N	R	V	Y
19	D	H	K	O	S	W	AA
20	D	H	L	P	T	X	BB
21	D	H	M	Q	U	Y	CC
22	D	I	M	R	V	AA	EE
23	E	I	N	R	W	BB	FF
24	E	J	N	S	X	CC	HH
25	E	J	O	T	Y	DD	II
26	E	J	P	U	Z	EE	JJ
27	E	K	P	V	AA	FF	LL
28	F	K	Q	V	BB	HH	NN
29	F	L	Q	W	CC	II	OO
30	F	L	R	X	DD	JJ	PP
31	F	L	S	Y	EE	KK	RR
32	F	M	S	Z	FF	LL	RR

[1] This table can be with any combination of clearance time forward speed.

[2] See Table 6-4 for clearance times.

[3] See Procedure (Step 5) of Evacuation Decision Worksheet for methods of determining forecast forward speed.

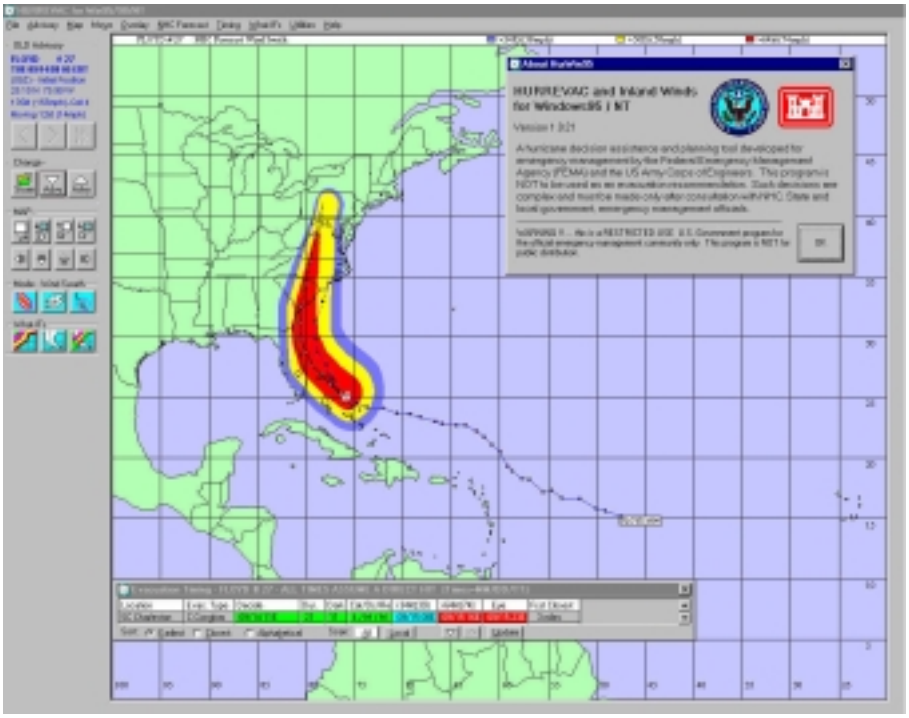
[4] "Arcs" refer to concentric circles on the Conglomerate Decision Arc Map.

7.6 ABOUT HURREVAC AND INLAND WINDS FOR WIN95 AND WIN/NT

7.6.1 What Is HURREVAC?

HURREVAC stands for HURRicane EVACuation program on a computer. The program was developed for the US Government, beginning in 1988**,** in response to a need for computer based management of data produced by various federal hurricane evacuation studies. The purpose of the studies, and of HURREVAC, is to assist government emergency managers in making timely and accurate decisions for their states/communities when under a hurricane threat.

HURREVAC, a hurricane decision assistance program for emergency managers, was originally developed for the State of South Carolina in late 1988 and was first used in SC and GA during the 1989 season, specifically with Hurricane Hugo. Subsequent to this, the program was implemented, along with location-specific graphics and evacuation data, in 13 additional states, the US virgin Islands and Puerto Rico from 1989 through 1997.



Prior to 1997, HURREVAC was a DOS Graphics program. A companion program, developed from 1995 and 1997, HURREVAC Inland Winds, was produced for use by the many inland counties who could be threatened by these storms after moving ashore. HURREVAC Inland Winds used the NHC Wind Decay Model (DeMaria and Kaplan 1996). In early 1998, work started on a new Windows95/NT version of the program that

would combine Coastal and Inland Winds versions of HURREVAC into one program. This new Win95/NT version (hereafter called HurWin95) was produced for the active portion of the 1998 hurricane season, and beta-tested during the 1998 season at over 120 sites throughout Federal, State, and Local Emergency Management sites. The new version makes HURREVAC as generic as possible, and applicable to many areas in the least amount of time. To make HURREVAC useful for an area, evacuation data file plug-ins to the program derived from the local Hurricane Evacuation Study area need to be completed to have access to the full capabilities (to include evacuation timing portions of the program, lists, decision arcs, etc.) of HurWin95.

7.6.2 How does HURREVAC work?

HURREVAC tracks hurricanes on computer plotted maps using information gathered directly from the National Hurricane Center (National Weather Service, NOAA) and estimates when various evacuation decisions should be made, using data from the federal hurricane evacuation study for the area. The process works this way –

- The arrival of gale (34 knots or 39mph) winds in your area is computed using the NHC projections with adjustment for a direct-hit or worst-case approach to your community.

- Clearance times (the time it takes to get occupants out) are computed using Saffir-Simpson scale category of storm, the existing roadway network, behavioral characteristics of the evacuating population, and housing and population values for the area. The data for clearance times is produced from the transportation analysis conducted during a Hurricane Evacuation Study performed by USACE and FEMA.

- The clearance time is subtracted from the gale arrival time to reach a suggested Evacuation Decision Time. This approach automates the manual Decision Arc method and is based upon the need to have the at-risk population out of vulnerable areas before gales reach the coast (when trees begin to block roads and causeways begin to inundate).

Storm Surge Inundation graphics, where available, are also displayed by the program, using data from the National Weather Service SLOSH (Sea, Lake and Overland Surge from Hurricanes) model.

7.6.3 Who can use HURREVAC?

HURREVAC for Win95/98/NT, DOS HURREVAC and HURREVAC Inland Winds are government programs restricted for use by the official government emergency management community. If you are the Emergency Manager for a county in the hurricane prone states (Texas to Maine), in Puerto Rico or the Virgin Islands, state Emergency Management Agency (EMA), a FEMA office, U.S. Army Corps of Engineers office or National Weather Service office, you are eligible to use the HURREVAC program.

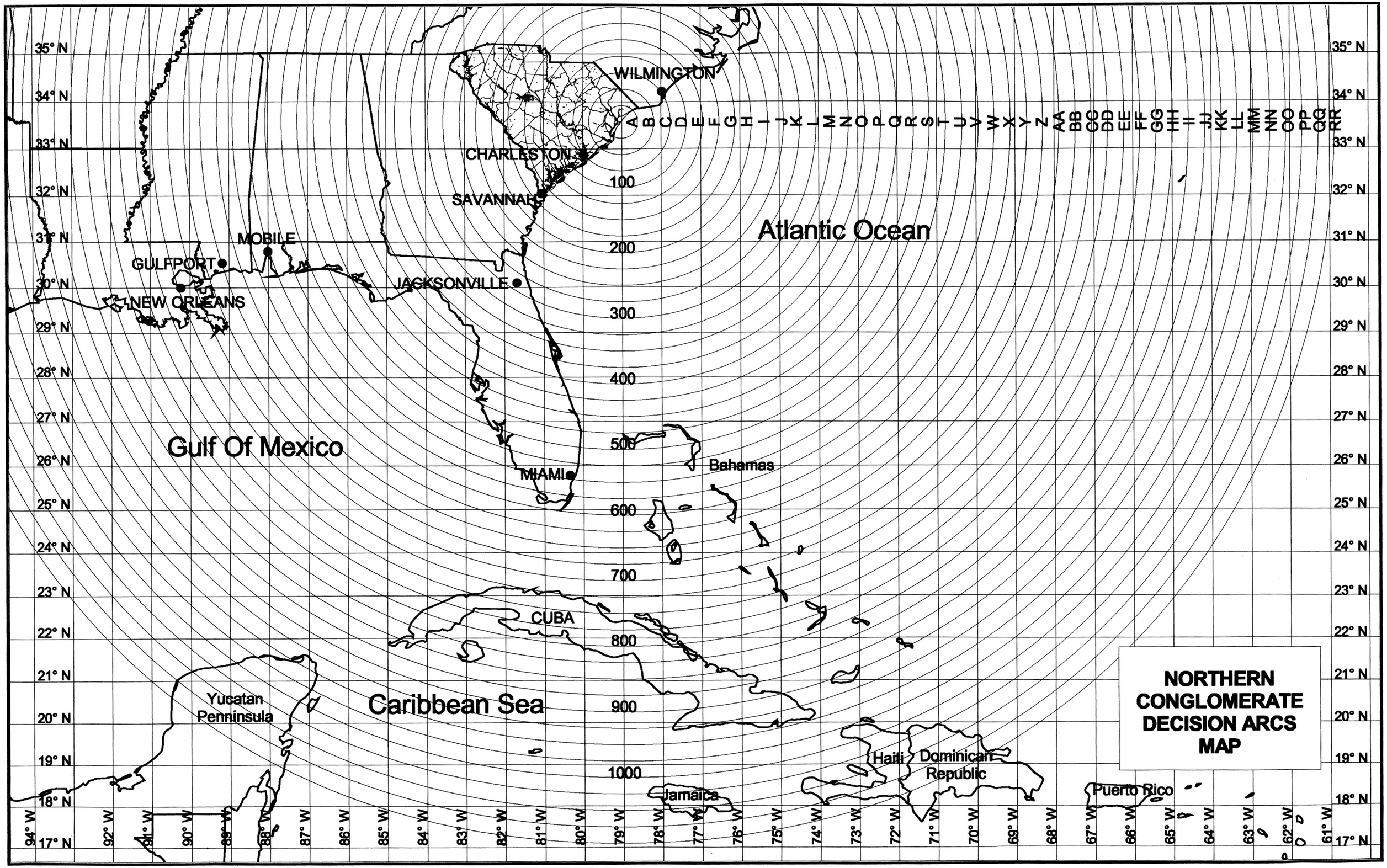

NORTHERN CONGLOMERATE DECISION ARCS MAP
WILMINGTON
CHARLESTON
SAVANNAH
MOBILE
GULFPORT
NEW ORLEANS
JACKSONVILLE
MIAMI
Atlantic Ocean
Gulf Of Mexico
Caribbean Sea
Bahamas
CUBA
Yucatan Penninsula
Haiti
Dominican Republic
Jamaica
Puerto Rico
100
200
300
400
500
600
700
800
900
1000
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z AA BB CC DD EE FF GG HH II JJ KK LL MM NN OO PP QQ RR
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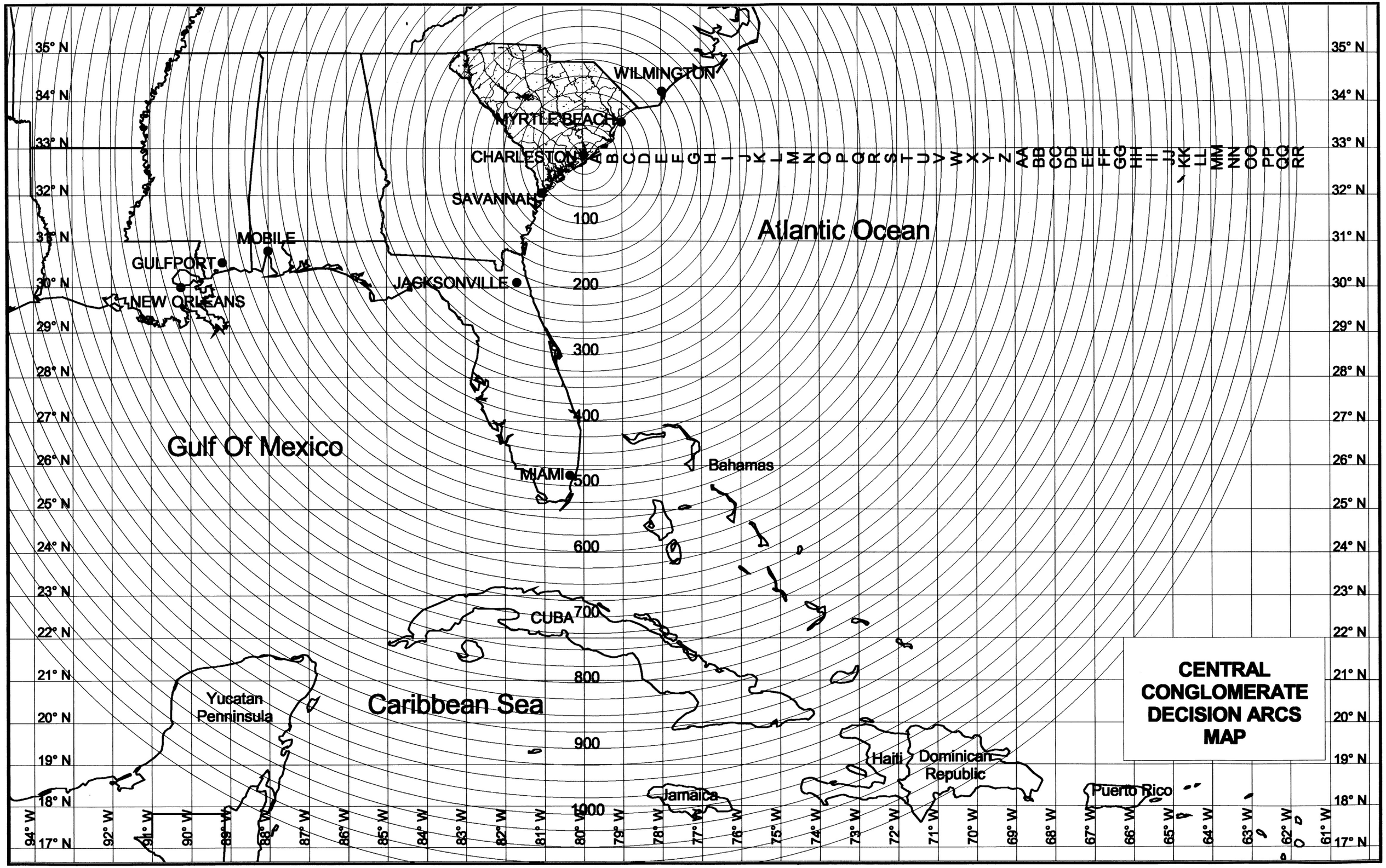
Figure 7-1


CENTRAL CONGLOMERATE DECISION ARCS MAP
Atlantic Ocean
Gulf Of Mexico
Caribbean Sea
WILMINGTON
MYRTLE BEACH
CHARLESTON
SAVANNAH
JACKSONVILLE
MOBILE
GULFPORT
NEW ORLEANS
MIAMI
Bahamas
CUBA
Yucatan Penninsula
Jamaica
Haiti
Dominican Republic
Puerto Rico
100
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61° W

Figure 7-2

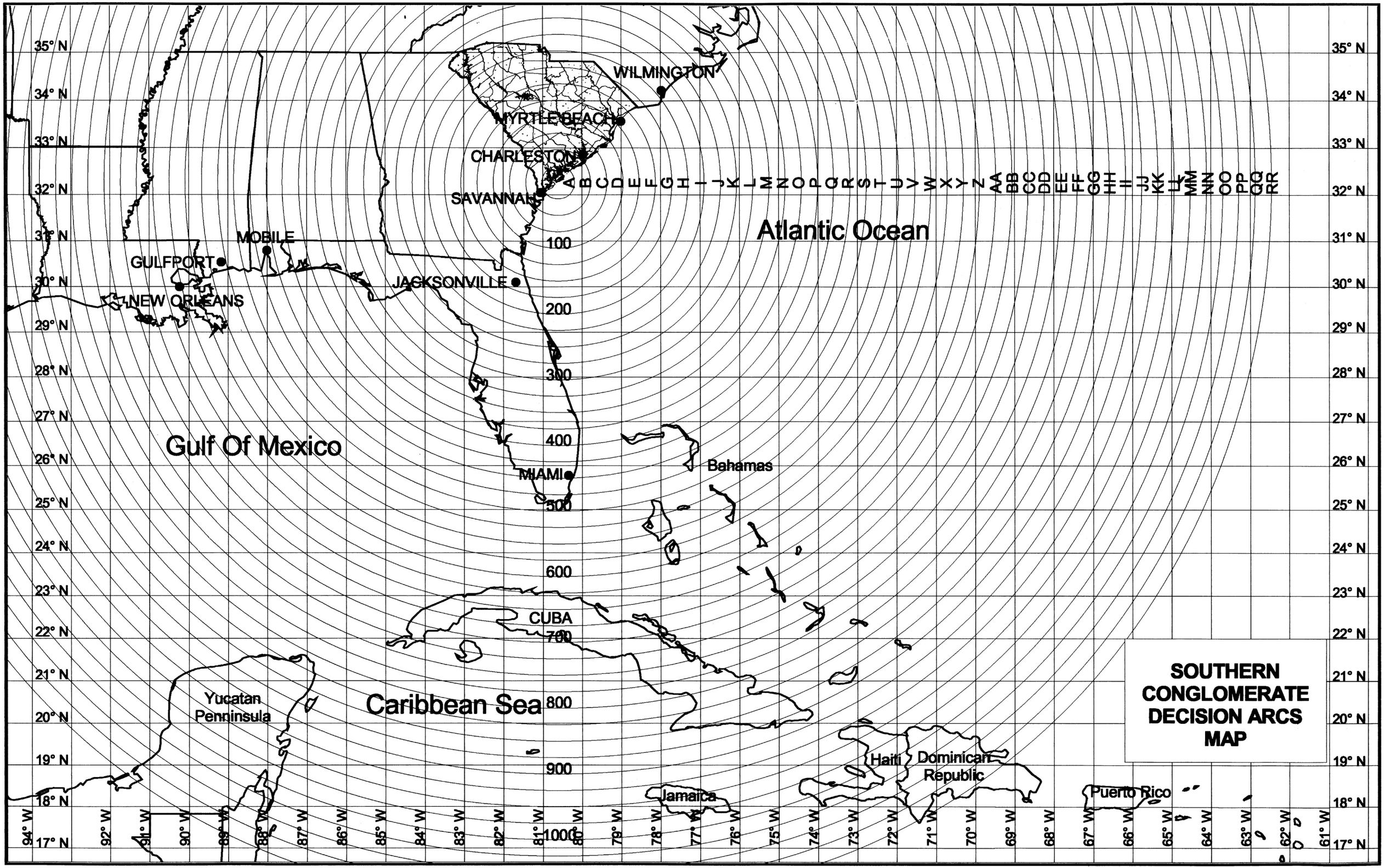
SOUTHERN CONGLOMERATE DECISION ARCS MAP
Atlantic Ocean
Gulf Of Mexico
Caribbean Sea
WILMINGTON
MYRTLE BEACH
CHARLESTON
SAVANNAH
MOBILE
GULFPORT
NEW ORLEANS
JACKSONVILLE
MIAMI
Bahamas
CUBA
Yucatan Penninsula
Jamaica
Haiti
Dominican Republic
Puerto Rico
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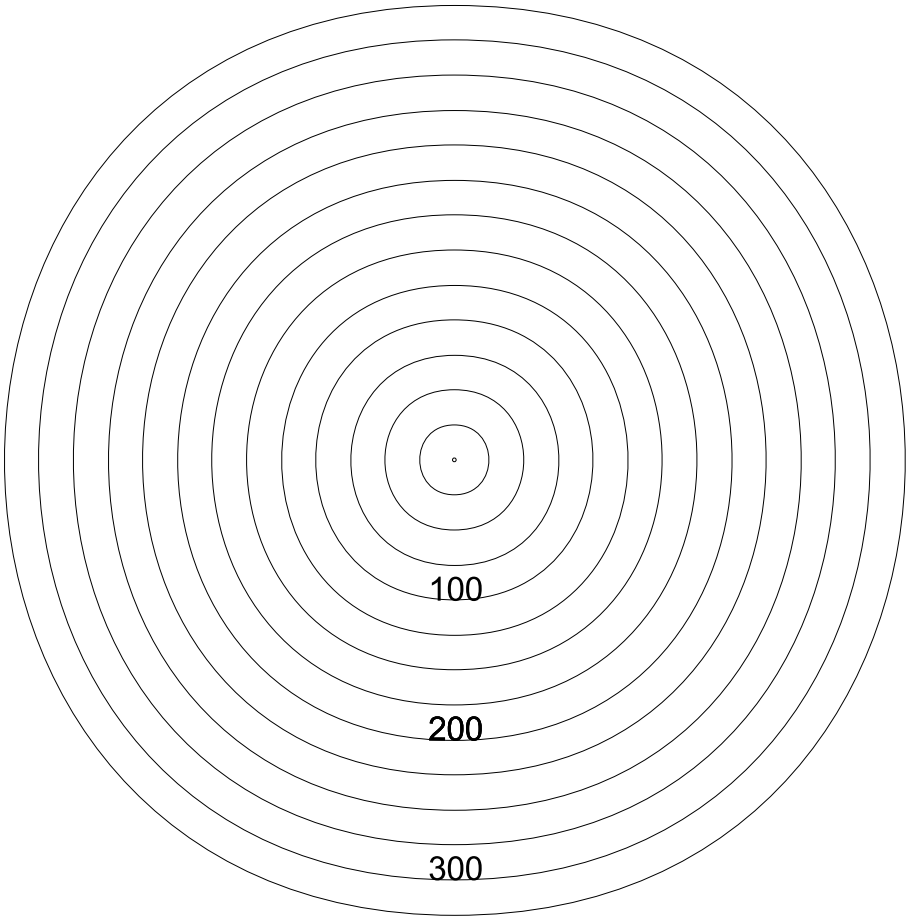
Figure 7-3

STORM TOOL



STORM TOOL
FOR
DECISION ARCS

DEPARTMENT OF THE ARMY

FIGURE 7-4

APPENDIX A

South Carolina Evacuation Area Descriptions

South Carolina Evacuation Area Descriptions

HORRY COUNTY EVACUATION AREAS

Category 1 Evacuation Area

All residents and tourists east of Business US 17 in the southern Grand Strand and east of US 17 in the northern Grand Strand area, all residents living in low lying areas along rivers, streams and creeks, and all manufactured housing residents.

Category 2 Evacuation Area

All residents and tourists east of Bypass US 17 in the southern Grand Strand and east of US 17 in the northern Grand Strand area, all residents living in low lying areas along rivers, streams, and creeks, and all manufactured housing residents.

Category 3 Evacuation Area

All residents and tourists east of Bypass US 17 in the southern Grand Strand and east of US 17 in the northern Grand Strand area, residents living in low lying areas along rivers, streams, and creeks, and all manufactured housing residents.

Category 4 Evacuation Area

All residents and tourists east of Bypass US 17 in the southern Grand Strand and east of US 17 in the northern Grand Strand area, residents living in low lying areas along rivers, streams, and creeks, and all manufactured housing residents.

Category 5 Evacuation Area

All residents and tourists east of Intracoastal Waterway, residents living in low lying areas along rivers, streams, and creeks, and all manufactured housing residents.

South Carolina Evacuation Area Descriptions

COLLETON COUNTY

Category 1 Evacuation Area

All residents and tourists south of US 17, including Edisto Beach, and all manufactured housing residents.

Category 2 Evacuation Area

All residents and tourists south of Alternate 17, Ritter Road, and south of the Iron Crossroads and Cottageville Communities; Edisto Beach; and all manufactured housing residents.

Category 3 Evacuation Area

All residents and tourists south of Alternate 17, Ritter Road, and south of the Iron Crossroads and Cottageville Communities; Edisto Beach; and all manufactured housing residents.

Category 4 Evacuation Area

All residents and tourists south of Alternate 17, Ritter Road, and south of the Iron Crossroads and Cottageville Communities; Edisto Beach; and all manufactured housing residents.

Category 5 Evacuation Area

All residents and tourists south of Alternate 17, Ritter Road, and south of the Iron Crossroads and Cottageville Communities; Edisto Beach; and all manufactured housing residents.

South Carolina Evacuation Area Descriptions

BEAUFORT COUNTY EVACUATION AREAS

Category 1 Evacuation Area

South of the Broad River:
On Hilton Head Island, all residents and tourists south of the Folly and Port Royal Plantation; those north of this area living within 300 yards of the Atlantic Ocean, Colleton River, Calibogue Sound, Port Royal Sound, and Broad Creek; all residents and tourists on Daufuskie, Lemon, Bull and Daws Islands; and all manufactured housing residents.

North of the Broad River:
All residents and tourists on Fripp, Hunting Island State Park, Morgan, Coosaw, Chisolm, Dataw, and Brays Islands; on St. Helena's Island those living oceanside of Seaside Road and Coffin Point Road; all remaining low lying areas adjacent to the Coosaw, Morgan, Combahee, Beaufort, Broad, and May Rivers; and all manufactured housing residents.

Category 2 Evacuation Area

All residents and tourists are asked to evacuate except those living south of US 278 and west and north of SC 46 to the Jasper County line

Category 3 Evacuation Area

All residents and tourists are asked to evacuate.

Category 4 Evacuation Area

All residents and tourists are asked to evacuate.

Category 5 Evacuation Area

All residents and tourists are asked to evacuate.

JASPER COUNTY EVACUATION AREAS

Category 1 Evacuation Area

All residents and tourists east of SC 462, south of SC 170 and west of Purrysburg Road (SC 34) up to Bagshaw Swamp; and all manufactured housing residents.

Category 2 Evacuation Area

All residents and tourists east of SC 462, south SC 170 and west of Purrysburg Road (SC 34) up to Bagshaw Swamp; and all manufactured housing residents.

Category 3 Evacuation Area

All residents and tourists east and south of I-95 and west of Purrysburg Road (SC 34); west of I-95, areas northwest of Hardeeville and south of Bagshaw Swamp and the Coosawhatchie area north of Taylor Mill Road (CR 175) and east of Loghaul Road (CR 39); and all manufactured housing residents.

Category 4 Evacuation Area

All residents and tourists east and south of I-95 and west of Purrysburg Road (SC 34); west of I-95, areas northwest of Hardeeville and south of Bagshaw Swamp and the Coosawhatchie area north of Taylor Mill Road (CR 175) and east of Loghaul Road (CR 39); and all manufactured housing residents.

Category 5 Evacuation Area

All residents and tourists east and south of I-95 and west of Purrysburg Road (SC 34); west of I-95, areas northwest of Hardeeville and south of Bagshaw Swamp and the Coosawhatchie area north of Taylor Mill Road (CR 175) and east of Loghaul Road (CR 39); and all manufactured housing residents.

HAMPTON COUNTY EVACUATION AREAS

Category 3 Evacuation Area

All residents and tourists in low lying areas along the Tulifinny River and all manufactured housing residents.

Category 4 Evacuation Area

All residents and tourists in low lying areas along the Tulifinny River and all manufactured housing residents.

Category 5 Evacuation Area

All residents and tourists in low lying areas along the Tulifinny River and all manufactured housing residents.

South Carolina Evacuation Area Descriptions

GEORGETOWN COUNTY EVACUATION AREAS

Category 1 Evacuation Area

All residents and tourists east of US 17 and US 17 Bypass in the northern portion of the county, residents living in low lying areas along rivers, streams, and creeks, and all manufactured housing residents.

Category 2 Evacuation Area

All residents and tourists east of US 17 and US 17 Bypass in the northern portion of the county, residents living in low lying areas along rivers, streams, and creeks, and all manufactured housing residents.

Category 3 Evacuation Area

All residents and tourists east of US 17 and US 17 Bypass in the northern portion of the county, the city of Georgetown, residents living in low lying areas along rivers, streams, and creeks, and all manufactured housing residents.

Category 4 Evacuation Area

All residents and tourists of the county who are east of Indian Hut Road and Nine Mile Curve, and east of US 701 from Georgetown/Horry county boundary to Highway 4 to include all residents east of the Intracoastal Waterway on the Waccamaw Neck; residents living in low lying areas along rivers, streams, and creeks, and all manufactured housing residents.

Category 5 Evacuation Area

All residents and tourists of the county who are east of Indian Hut Road and Nine Mile Curve, and east of US 701 from Georgetown/Horry county boundary to Highway 4 to include all residents east of the Intracoastal Waterway on the Waccamaw Neck; residents living in low lying areas along rivers, streams, and creeks, and all manufactured housing residents.

South Carolina Evacuation Area Descriptions

BERKELEY COUNTY EVACUATION AREAS

Category 1 Evacuation Area

All residents and tourists south of Clements Ferry Road and south of Halfway Creek Road to Guerins Bridge Road, and those living along the Cooper River south of Hagan Plantation between one mile east of the Cooper River and one mile west of the Back River; also those residents living in low lying areas along the Goose Creek Reservoir; and all manufactured housing residents.

Category 2 Evacuation Area

All residents and tourists south of Clements Ferry Road, and south of Halfway Creek Road to Guerins Bridge Road, and those living along the Cooper River south of Hagan Plantation between one mile east of the Cooper River and one mile west of the Back River; also those residents living in low lying areas along the Goose Creek Reservoir; and all manufactured housing residents.

Category 3 Evacuation Area

All residents and tourists south of Clements Ferry Road, and south of Halfway Creek Road to Guerins Bridge Road, and those living along the Cooper River south of Hagan Plantation between one mile east of the Cooper River and one mile west of the Back River; also those residents living in low lying areas along the Goose Creek Reservoir; and all manufactured housing residents.

Category 4 Evacuation Area

All residents and tourists south of Clements Ferry Road, and south of Halfway Creek Road to Guerins Bridge Road, and those living along the Cooper River south of Hagan Plantation between one mile east of the Cooper River and one mile west of the Back River; also those residents living in low lying areas along the Goose Creek Reservoir, the area between Honey Hill and Wambaw Creek, low lying areas along the Santee River south of Jamestown; and all manufactured housing residents.

Category 5 Evacuation Area

All residents and tourists south of Clements Ferry Road, and south of Halfway Creek Road to Guerins Bridge Road, and those living along the Cooper River south of Hagan Plantation between one mile east of the Cooper River and one mile west of the Back River; also those residents living in low lying areas along the Goose Creek Reservoir, the area between Honey Hill and Wambaw Creek, low lying areas along the Santee River south of Jamestown; and all manufactured housing residents.

DORCHESTER COUNTY EVACUATION AREAS

Category 1 Evacuation Area

Residents living in low lying areas along Rantowles Creek; and all manufactured housing residents.

Category 2 Evacuation Area

Residents living in low lying areas along Rantowles Creek; and all manufactured housing residents.

Category 3 Evacuation Area

Residents living in low lying areas along Rantowles Creek; and all manufactured housing residents.

Category 4 Evacuation Area

Residents living along County Line Road between Edisto River and SC 165, and those living in low lying areas along Rantowles Creek; and all manufactured housing residents.

Category 5 Evacuation Area

Residents living along County Line Road between Edisto River and SC 165, and those living in low lying areas along Rantowles Creek; and all manufactured housing residents.

South Carolina Evacuation Area Descriptions

CHARLESTON COUNTY EVACUATION AREAS

Category 1 Evacuation Area

West Ashley Area:
All residents and tourists on barrier islands including Edisto, Seabrook, Kiawah, Folly Beach; on Johns Island, all residents between River Road, and the Stono River, Kiawah River, and Edisto River; on Wadmalaw Island, residents in low lying areas near the North Edisto River, Wadmalaw River, the Wadmalaw Sound, Leadenwah Creek, Bohicket Creek and Church Creek; on James Island, residents in low lying areas near the Stono River, Clark Sound, Parrot Point Creek, James Island Creek, the Harbor and Wappoo Creek; remaining residents between Ashley River Road and the Ashley River; remaining residents in low lying areas along the South Edisto River, Wallace and Rantowles Creeks, Russell Creek, Dawhoo River, and the Toogoodoo Creek; and all manufactured housing residents.

Charleston Peninsula and Charleston Neck Area:
All residents and tourists residing in areas east of East Bay Street, south of Broad Street, and west of Ashley Avenue; in the Charleston Neck, those in low lying areas along Ashley River, Cooper River, Town Creek, and Shipyard Creek; and all manufactured housing residents.

North Charleston Area:
All residents and tourists between Dorchester Road and the Ashley River; and low lying areas along Cooper River and Noisett Creek; and all manufactured housing residents.

East Cooper Area:
All residents and tourists on barrier islands including Sullivans Island, Isle of Palms, Goat Island, Dewees Island, and Capers Island; and all areas in the Awendaw and McClellanville areas southeast of the Intracoastal Waterway from Hamlin Sound to the Georgetown County line; in Mount Pleasant, areas southeast of Rifle Range Road and low lying areas along Toler's Cove, Shem Creek, Cooper River, Wando River, Molasses Creek, Hobcaw Creek and Horlbeck Creek; and all manufactured housing residents.

Category 2 Evacuation Area

West Ashley Area:
All residents and tourists on barrier islands including Edisto, Seabrook, Kiawah, James Island, and Folly Beach; on Johns Island, all residents between River Road, and the Stono River, Kiawah River, and Edisto Rivers; on Wadmalaw Island, in low lying areas near the North Edisto River, Wadmalaw River, the Wadmalaw Sound, Leadenwah Creek, Bohicket Creek and Church Creek; remaining residents between Ashley River Road and the Ashley River; residents between the Mark Clark Expressway and Bees Ferry Road, and remaining residents in low lying areas along the South Edisto River, Wallace and Rantowles Creeks, Russell Creek, Dawhoo River, and the Toogoodoo Creek; and all manufactured housing residents.

CHARLESTON COUNTY EVACUATION AREAS (Cont.)

Charleston Peninsula and Charleston Neck Area:
All residents and tourists southeast of the I-26/Rutledge Avenue exit; in the Charleston Neck all residents between King Street and the Ashley River, between Meeting Street and the Cooper River, and in low lying areas along Town Creek and Shipyard Creek; and all manufactured housing residents.

North Charleston Area:
All residents between Dorchester Road and the Ashley River and those in low lying areas along Noisett Creek and the Cooper River (including the Old Naval Shipyard); and all manufactured housing residents.

East Cooper Area:
All residents and tourists on barrier islands including Sullivans Island, Isle of Palms, Goat Island, Dewees Island and Capers Island; in Mount Pleasant, areas southeast of Rifle Range Road and low lying areas along Toler's Cove, Shem Creek, Cooper River, Wando River, Molasses Creek, Hobcaw Creek and Horlbeck Creek; also the Whitehall Terrace area; and areas southeast of US 17 from Hamlin Sound to the Georgetown County line to include Awendaw and McClellanville; and all manufactured housing residents.

Category 3 Evacuation Area

West Ashley Area:
All residents and tourists except for those residing in and northwest of the town of Ravenel, Hollywood, and Meggett; and all manufactured housing residents.

Charleston Peninsula and Charleston Neck Area:
All residents and tourists southeast of Cosgrove Avenue.

North Charleston Area:
All residents west of I-26 and south of Montague Ave; remaining areas between Dorchester Road and the Ashley River; low lying areas around Noisett Creek; and all manufactured housing residents.

East Cooper Area:
All residents and tourists east of the Cooper River to the Georgetown County line.

Category 4 Evacuation Area

West Ashley Area:
All residents and tourists except for those residing in and northwest of the town of Ravenel, Hollywood, and Meggett; and all manufactured housing residents.

Charleston Peninsula and Charleston Neck Area:
All residents and tourists southeast of Cosgrove Avenue.

CHARLESTON COUNTY EVACUATION AREAS (Cont.)

North Charleston Area:
All residents west of I-26 and south of Montague Ave; remaining areas between Dorchester Road and the Ashley River; low lying areas around Noisett Creek; and all manufactured housing residents.

East Cooper Area:
All residents and tourists east of the Cooper River to the Georgetown County line.

Category 5 Evacuation Area

West Ashley Area:
All residents and tourists west of the Ashley River.

Charleston Peninsula and Charleston Neck Area:
All residents and tourists southeast of Cosgrove Ave.

North Charleston Area:
The area west of I-26 and south of Montague Ave; remaining areas between Dorchester Road and the Ashley River; low lying areas around Noisett Creek; and all manufactured housing residents.

East Cooper Area:
All residents and tourists east of the Cooper River to the Georgetown County line

APPENDIX B

Traffic Management/Control Points

Traffic Management / Law Enforcement

Northern Coastal Conglomerate Annex

1. General. Evacuation of the population away from vulnerable areas is one of the most crucial issues in protecting lives in the face of an approaching hurricane. The basic traffic concept is to allow traffic to flow in its normal patterns and to use existing traffic control devices to control the flow. To supplement these existing traffic control devices, law enforcement personnel will staff selected Traffic Control Points (TCPs) within the conglomerate. Each TCP has been established to provide assistance to the evacuating populace. The various law enforcement agencies working in the conglomerate will be responsible for pre-determined TCPs.

2. Traffic Control Point (TCP) Responsibilities. The following TCPs were compiled by the South Carolina Department of Public Safety/South Carolina Highway Patrol in cooperation with local law enforcement agencies. This effort was coordinated by the South Carolina Law Enforcement Division (SLED) acting as the primary agency for the law enforcement emergency support function (ESF). Many of the TCPs may be staffed by the South Carolina National Guard. In the listing below, when personnel requirements are indicated, the staffing represents a twenty-four hour period.

County/Id	Location	Responsible Agency
CLARENDON COUNTY		
1	US 521 & SC 261, to block SC 261 traffic and allow evacuating traffic on US 521 to flow smoothly.	Clarendon County Sheriff (2)
2	US 521, SC 261 & Sec. 30, to block Sec. 30 traffic and allow evacuating traffic on US 521 to flow smoothly.	Manning Police Dept. (2)
3	US 301 & SC 261, to block US 301 traffic and allow evacuating traffic on SC 261 to flow smoothly	Manning Police Dept. (4)
4	SC 261 & Sec. 133, to block Sec. 133 traffic and allow evacuating traffic on SC 261 to flow smoothly.	Manning Police Dept. (4)
5	SC 261 & Sec. 97, to block Sec 97 traffic and allow evacuating traffic on SC 261 to flow smoothly.	Manning Police Dept. (4)
6	SC 261 & Sec. 769, to block Sec. 769 traffic and allow evacuating traffic on SC 261 to flow smoothly.	Manning Police Dept. (4)

County/Id	Location	Responsible Agency
7	SC 261 & Sec. 63, to block Sec. 63 traffic and allow evacuating traffic on SC 261 to flow smoothly.	SC Highway Patrol (4)
8	US 378 & US 301, to block traffic on US 301 and allow evacuating traffic to flow smoothly on US 378.	Turbeville Police Dept. (2)
DARLINGTON COUNTY		
1	Highway US 52 Business & US 52 Bypass, to control the intersection and allow evacuating traffic to turn left onto US 52 Bypass north. Also to allow traffic to cross US 52 from S-179 smoothly.	SC Highway Patrol (6)
2	Highway US 52 Bypass & SC-340, to monitor intersection and intervene when necessary, to allow traffic to flow freely.	SC Highway Patrol (6)
3	Highway US 52 Bypass & US 401, to monitor intersection and intervene when necessary, to allow traffic to flow freely.	SC Highway Patrol (6)
4	Highway US 52 Bypass & SC-151, to turn traffic left onto SC-151 west toward Hartsville.	Darlington PD (4)
5	Highway SC-151 & SC-151 Bypass, to monitor intersection and intervene when necessary, to allow traffic to flow freely.	SC Highway Patrol (4)
6	Highway SC-151 Bypass & US 15, to monitor intersection and intervene when necessary, to allow traffic to flow freely.	SC Highway Patrol (4)
7	Highway SC-151 Bypass & S-10 (Kelly Town Rd.), to monitor intersection and intervene when necessary, to allow traffic to flow freely.	SC Highway Patrol (4)
8	Highway SC-151 & S-23 (Old Camden Rd.), to monitor intersection and intervene when necessary, to allow traffic to flow freely.	SC Highway Patrol (4)
DILLON COUNTY		

County/Id	Location	Responsible Agency
1	US 301 & SC 917, to ensure orderly flow of Northbound evacuating traffic.	Latta Police Dept. (4)
2	SC 9-Lakeview, to ensure that westbound evacuating traffic flows smoothly at left turn at caution light.	Lake View Police Dept. (4)
3	SC 9 and SC 57, to maintain smooth flow of westbound evacuating traffic through the intersection.	Dillon Police Dept. (4)
4	SC 9 and US 301, to maintain smooth flow of evacuation traffic from SC 9 northbound onto US 301.	SC Highway Patrol (6)
5	US 301 and Harrison St., to maintain smooth flow of northbound evacuating traffic.	Dillon Police Dept. (4)
6	US 301 and Jackson St., to maintain smooth flow of northbound evacuating traffic.	Dillon Police Dept. (4)
7	US 301 and SC 9 Bypass, to maintain smooth flow of evacuation traffic westbound from US 301-501 onto SC 9 Bypass.	SC Highway Patrol (6)
FLORENCE COUNTY		
1	Johnsonville: Hwy 341 & 41/51, to block intersection to allow traffic to flow north on Hwy 41/51.	Johnsonville Police Dept. (6)
2	Kingsburg: Hwy 378 & 51, to assist traffic to merge west on Hwy 378.	Florence County Sheriff (4)
3	Lake City: Hwy 378 & 341 west end of Bypass, to allow traffic to flow freely west on 378 or 341.	SC Highway Patrol (4)
4	Lake City and Church St, to assist traffic proceeding west through Lake City.	Lake City Police Dept. (6)
5	Lake City: Highway 341 and 378/52, to assist traffic to flow west on 378-341 toward I-95 or I-20.	Lake City Police Dept. (6)
6	Olanta: Highway 341 and 301, to assist traffic on 341 to cross 301.	Olanta Police Dept. (4)
7	Effingham: Highway 301 and 52, to allow traffic to flow freely.	SC Highway Patrol (4)

County/Id	Location	Responsible Agency
8	Southside School: Highway 301 and 57, to assist traffic to flow freely north on 301/52.	Florence County Sheriff (6)
9	Third Loop and Highway 52-301, to allow traffic to flow north freely on 52/301.	Florence Police Dept. (6)
10	Highway 51 and 57, to allow traffic to flow freely north on 51 or west on S-21-57.	SC Highway Patrol (6)
11	Highway 52/51 Coles Cross Roads, to allow traffic to flow freely through the intersection.	Florence Police Dept. (6)
12	S-21-13 and Highway 52, to allow traffic to flow freely.	Florence Police Dept. (6)
13	US 76/301 & Highway 52, to allow traffic to flow north on 52 or west on 76.	Florence Police Dept. (6)
14	Highway 52 and TV Road, to allow traffic to flow freely north.	Florence Police Dept. (6)
15	Highway 52 and S-21-62, to allow traffic to flow north freely.	Florence County Sheriff (6)
16	Highway 52 & S-21-29, to allow traffic to flow north freely.	SC Highway Patrol (6)
17	Highway 52 & I-95, to allow traffic to flow freely north and south.	SC Highway Patrol (6)
18	US-76 & S-24, to allow traffic to flow freely west.	Florence County Sheriff (6)
19	Francis Marion Highway 327 and 76, to allow traffic to flow west freely.	SC Highway Patrol (6)
20	Flea Market, Highway 327 and 76, to allow traffic to flow freely.	Florence County Sheriff (6)
21	Highway 327/S-21-24 Old Marion, to allow traffic to flow freely.	SC Highway Patrol (6)
22	I-95 and Highway 327, to assist traffic to enter I-95 from 327.	Florence County Sheriff (4)

County/Id	Location	Responsible Agency
23	I-95 and US 52, to assist traffic to enter I-95 from 52.	SC Highway Patrol (6)
GEORGETOWN COUNTY		
1	US 17 & SC 707.	SC Highway Patrol (6)
2	US 17 & Wachesa Rd.	SC Highway Patrol (4)
3	US 17 Litchfield Traffic Light.	SC Highway Patrol (6)
4	US 17 & North Causeway.	SC Highway Patrol (6)
5	US 17 & South Causeway.	SC Highway Patrol (4)
6	US 17 & Wood St.	Georgetown PD (6)
7	US 17 & US 521.	Georgetown PD (6)
8	US 17 & Highmarket St.	Georgetown PD (6)
9	US 17A & Sec 71.	SC Highway Patrol (6)
10	US 701 & SC 51.	SC Highway Patrol (6)
11	SC 41 & SC 51.	SC Highway Patrol (6)
12	US 521 & US 17A.	SC Highway Patrol (6)
13	US 17A & SC 41.	SC Highway Patrol (6)
14	US 521 & SC 41.	SC Highway Patrol (6)
HORRY COUNTY		
1	US 501 & 3rd Avenue.	Myrtle Beach PD (6)
2	US 501 & Sec. 600.	Myrtle Beach PD (6)
3	US 501 & US 17.	SC Highway Patrol (6)
4	US 501 & Pottery Light.	SC Highway Patrol (6)
5	US 501 & Forestbrook Road.	SC Highway Patrol (6)
6	US 501 & Hospital Road.	SC Highway Patrol (6)
7	US 501 & College Road.	SC Highway Patrol (6)

County/Id	Location	Responsible Agency
8	US 501 & US 501 Business.	Conway City PD (6)
9	US 501 & SC 544, at interchange.	SC Highway Patrol (4)
10	US 501 & SC 544, at traffic light.	SC Highway Patrol (6)
11	US 501 & US 378.	City Police Dept. (6)
12	US 501 & Sec. 24, traffic light at Aynor.	Aynor Police Dept. (4)
13	US 501 & SC 319.	Aynor Police Dept. (6)
14	SC 544 & US 17 Bypass.	SC Highway Patrol (6)
15	SC 544 & SC 544 Connector.	SC Highway Patrol (4)
16	SC 544 & Hospital Road.	SC Highway Patrol (4)
17	SC 544 & College Road.	SC Highway Patrol (4)
18	SC 9 & Sec. 20.	SC Highway Patrol (4)
19	SC 9 & Sec. 57.	SC Highway Patrol (6)
20	US 17 Business South & SC 544.	SC Highway Patrol (6)
21	10th Ave & US 17 Bypass.	SC Highway Patrol (4), Horry County PD (2)
22	Highway 15 & 3rd Ave.	Myrtle Beach PD (4)
23	21st Ave & 17 Bypass.	Myrtle Beach PD (6)
24	29th Ave & US 17 Bypass.	Myrtle Beach PD (6)
25	38th Ave & US 17 Bypass.	SC Highway Patrol (4), Horry County PD (2)
26	48th Ave & US 17 Bypass.	SC Highway Patrol (4), Horry County PD (2)
27	62th & US 17 Bypass.	SC Highway Patrol (4), Horry County PD (2)
28	US 17 Bypass & US 17 Business.	SC Highway Patrol (2), Myrtle Beach PD (2)

County/Id	Location	Responsible Agency
29	US 17 & Lake Arrow Head Rd.	SC Highway Patrol (4), Horry County PD (2)
30	US 17 & Chestnut Rd.	SC Highway Patrol (4), Horry County PD (2)
31	US 17 & Briarcliff Mall.	SC Highway Patrol (4), Horry County PD (2)
32	US 17 & Secondary 50 (Mineola) (Little River).	SC Highway Patrol (4), Horry County PD (2)
33	US 17 & SC 179 (Little River).	SC Highway Patrol (4), Horry County PD (2)
34	US 17 Bypass & Jetprot Rd.	SC Highway Patrol (4), Horry County PD (2)
35	US 17 Bypass & Garden City Connector.	SC Highway Patrol (4), Horry County PD (2)
36	US 17 Business & Atlantic Ave.	SC Highway Patrol (4), Horry County PD (2)
37	Atlantic Ave & Waccamaw Dr. (Garden City).	Horry County PD (4)
38	Highway 17 Business & Air Force Base.	Sheriff's Dept. (6)
39	Highway 17 Business & Melondy Dr.	Sheriff's Dept. (4)
40	Highway 17 Business & McDowell Shortcut Rd.	Sheriff's Dept. (6)
41	Highway 17 Bypass & Highway 707 (Murrells Inlet).	Georgetown County Sheriff (6)
MARION COUNTY		
1	US 501 & S 34-32 at caution light at Rains.	SC Highway Patrol (4)
2	US 501 & SC 41 Alt.	SC Highway Patrol (6)
3	US 501 & SC 576 at traffic light, to monitor intersection and intervene when necessary, to allow traffic to flow freely towards Florence.	SC Highway Patrol (4)

County/Id	Location	Responsible Agency
4	US 76 & SC 576, to monitor intersection and to intervene when necessary.	SC Highway Patrol (4)
5	SC 917 & S-34-31 at Red Hill Cemetery.	SC Highway Patrol (4)
6	US 378 & SC 41 Alt, to allow traffic to flow west.	SC Highway Patrol (4)
7	US 501 Bypass & SC 41Alt. at traffic light, to allow traffic to flow freely north towards Interstate I-95, intervene only when necessary.	SC Highway Patrol (6)
8	US 501 & SC 38, to monitor traffic from US 501 turning left onto SC 38 towards Interstate I-95.	Marion County Sheriff (4)
9	US 76 & US 301 at PeeDee (westbound), to monitor traffic traveling towards Florence.	Marion County Sheriff (4)
10	SC 576 & S 34-65 at the caution light at Greenwood Park.	Marion County Sheriff (6)
MARLBORO COUNTY		
1	Highway 38 & Highway 381, to allow evacuating traffic on Highway 38 to flow smoothly.	Marlboro County Sheriff (4)
2	Highway 38 & Highway 15/401, to allow evacuating traffic to flow smoothly.	SC Highway Patrol (4)
3	Highway 15/401 & Cottingham Blvd, to provide traffic control and allow evacuating traffic to flow.	Bennettsville Police Dept. (4)
4	Main Street & Cheraw Street, to allow evacuating traffic to flow smoothly.	Bennettsville Police Dept. (4)
5	Highway 9 & Highway 15/401, to allow evacuating traffic on Highway 9 to flow smoothly.	Marlboro County Sheriff (4)
6	Highway 9 & Highway 177, to provide traffic control and allow evacuating traffic on Highway 177, merging to Highway 9 West to flow smoothly.	Marlboro County Sheriff (4)
7	Highway 9 & Highway 1, to allow traffic to flow smoothly west on Highway 9 and north on Highway 1.	SC Highway Patrol (4)

County/Id	Location	Responsible Agency
8	Highway 15/401, to allow evacuating traffic to flow smoothly.	McColl Police Dept. (4)
9	Highway 381 Gibson Ave & Highway 381, to allow evacuating traffic to flow smoothly.	McColl Police Dept. (4)
SUMTER COUNTY		
	No traffic control points.	
WILLIAMSBURG COUNTY		
1	US 52 at SC 512, to allow traffic to enter US 52 north bound from SC 512.	Williamsburg County Sheriff (4)
2	US 52 at US 521 (Greeleyville crossroads), to block traffic on US 52 to allow evacuating traffic on US 521 to flow freely.	SC Highway Patrol (4), Greeleyville PD (2)
3	US 52 at SC 375, to block traffic on US 52 when needed to allow evacuating traffic to turn onto SC 375	Williamsburg County Sheriff (4)
4	US 521 at SC 377, to allow evacuating traffic to enter Kingstree, SC on SC 377.	Williamsburg County Sheriff (4)
5	SC 41 at SC 51, to block traffic on SC 41 to allow evacuating traffic on SC 51 to cross SC 41 freely.	SC Highway Patrol (6)
6	SC 261 at Sec. 24, to block traffic when needed on SC 261 to allow evacuating traffic on Sec. 24 to enter SC 261 west bound.	Williamsburg County Sheriff (4)
7	SC 261 at SC 512, to allow evacuating traffic to enter SC 512 from SC 261.	Williamsburg County Sheriff (4), Hemingway PD (2)
8	SC 41 at SC 527, to allow evacuating traffic on SC 41 to turn onto SC 527.	SC Highway Patrol (4)
9	SC 261 at SC 377, to allow evacuating traffic on SC 377 to turn left onto SC 261.	Kingstree PD (4)
10	SC 261 at US 52, to allow evacuating traffic to flow smoothly through intersection.	Kingstree PD (6)

County/Id	Location	Responsible Agency
11	SC 261 at SC 41, to allow evacuating traffic on SC 261 to cross SC 41 freely.	Hemingway PD (4)
12	US 521 at SC 375, to block traffic on SC 375 when needed to allow evacuating traffic on US 521 to flow freely.	Greeleyville PD (4)

Traffic Management / Law Enforcement

Central Coastal Conglomerate Annex

1. General. Evacuation of the population away from vulnerable areas is one of the most crucial issues in protecting lives in the face of an approaching hurricane. The basic traffic concept is to allow traffic to flow in its normal patterns and to use existing traffic control devices to control the flow. To supplement these existing traffic control devices, law enforcement personnel will staff selected Traffic Control Points (TCPs) within the conglomerate. Each TCP has been established to provide assistance to the evacuating populace. The various law enforcement agencies working in the conglomerate will be responsible for pre-determined TCPs.

2. Traffic Control Point (TCP) Responsibilities. The following TCPs were compiled by the South Carolina Department of Public Safety/South Carolina Highway Patrol in cooperation with local law enforcement agencies. This effort was coordinated by the South Carolina Law Enforcement Division (SLED) acting as the primary agency for the law enforcement emergency support function (ESF). Many of the TCPs may be staffed by the South Carolina National Guard. In the listing below, where personnel requirements are indicated, the staffing represents a twenty-four hour period.

County/Id	Location	Responsible Agency
BERKELEY COUNTY		
1	Highway 45 & Highway 41	SC Highway Patrol (2)
2	Highway 41 & S-1032	SC Highway Patrol (2)
3	Highway 52 & Highway 17-A	SC Highway Patrol (4)
4	Highway 52 & Highway 176	SC Highway Patrol (4)
5	Interstate 26 & Highway 172	SC Highway Patrol (2)
6	Interstate 26 & S-16.	SC Highway Patrol (4)
7	Interstate 26 & S-62	SC Highway Patrol (4)
8	Highway 52 & Highway 6	SC Highway Patrol (2)
9	Highway 176 & Highway 17-A	SC Highway Patrol (3)

County/Id	Location	Responsible Agency
10	Highway 176 & S-27	SC Highway Patrol (2)
11	Interstate 26 & Highway 17-A	SC Highway Patrol (2)
CALHOUN COUNTY		
1	Highway 176 & 601	SC Highway Patrol (Monitor)
CHARLESTON COUNTY		
100 Charleston City Police Department		
101	Glen McConnell Pkway & Bees Ferry Rd.	Charleston City Police
102	Folly Rd. & Ft. Johnson Rd.	Charleston City Police
103	Folly Rd. & Harborview Rd.	Charleston City Police
104	Haborview Rd. & James Island Expressway	Charleston City Police
105	Folly Rd. & Maybank Hwy.	Charleston City Police
106	Bees Ferry Rd. & Highway 61	Charleston City Police
107	Main Rd. & Maybank Highway	Charleston City Police
108	Maybank Highway & River Rd.	Charleston City Police
109	Main Rd. & River Rd.	Charleston City Police
110	Folly Rd. & Windmere	Charleston City Police
111	Highway 17 & Wesley Dr.	Charleston City Police
112	Highway 61 & Wesley Dr.	Charleston City Police
113	James Island Expressway at Folly Rd.	Charleston City Police
114	Hwy. 61 & Hwy. 171	Charleston City Police
115	Highway 61 & Playground Rd.	Charleston City Police
116	Highway 61 & Wappoo Dr.	Charleston City Police
117	Highway 61 & Highway 7	Charleston City Police
118	Highway 61 & Savage Rd.	Charleston City Police

County/Id	Location	Responsible Agency
119	Highway 17 & Highway 7	Charleston City Police
120	Highway 7 & Skylark Rd.	Charleston City Police
121	Highway 17 & Skylark Rd.	Charleston City Police
122	Highway 17 & Wappoo Rd.	Charleston City Police
123	Highway 7 & Orangegrove Rd.	Charleston City Police
124	Wm. Kennerty Dr. & Hwy. 61	Charleston City Police
125	Riverland Dr. & Maybank Highway	Charleston City Police
126	Highway 61 & Ashley Hall Rd.	Charleston City Police
127	Hwy. 7 & Ashley Hall Rd.	Charleston City Police
128	Brownswood Rd. & River Rd.	Charleston City Police
129	Brownswood Rd. & Main Rd.	Charleston City Police
130	Mark Clark & Highway 61	Charleston City Police
132	Mark Clark & Highway 7	Charleston City Police
133	Spring St. & Lockwood Dr.	Charleston City Police
134	Highway 17 & Coming St. (I-26)	Charleston City Police
135	Meeting St. & Calhoun Street	Charleston City Police
136	Calhoun St. & James Island Expressway	Charleston City Police
137	East Bay St. & Cooper St.	Charleston City Police
138	Hwy. 7 & Hwy. 171	Charleston City Police
139	Highway 17 & Mark Clark off Ramp	Charleston City Police
140	Clements Ferry Rd/Hwy 33 & Mark Clark	Charleston City Police
200 Charleston County Sheriff		
201	Rifle Range & Hamlin Rd.	Charleston County Sheriff
202	Hamlin Rd. & Highway 17	Charleston County Sheriff

County/Id	Location	Responsible Agency
203	Porcher Bluff Rd. & Highway 17	Charleston County Sheriff
204	Highway 17 & Highway 41	Charleston County Sheriff
205	Highway 17 & Steed Creek Rd.	Charleston County Sheriff
206	Highway 17 & Highway 45	Charleston County Sheriff
207	Highway 17 & Seewee Rd. (Southend)	Charleston County Sheriff
208	Highway 17 & Bees Ferry Rd.	Charleston County Sheriff
209	Hwy. 17 & Savage Rd.	Charleston County Sheriff
210	Kiawah Island Parkway & Bohicket Rd.	Charleston County Sheriff
211	Hwy. 174 & Hwy. 164	Charleston County Sheriff
212	Highway 174 & Highway 17	Charleston County Sheriff
213	Highway 174 & Highway 162	Charleston County Sheriff
214	Highway 162 & Highway 17	Charleston County Sheriff
215	Highway 165 & Highway 17	Charleston County Sheriff
216	Highway 17 & Davidson Rd.	Charleston County Sheriff
217	Highway 165 & Hwy. 162	Charleston County Sheriff
218	Main Rd. & Highway 17	Charleston County Sheriff
219	Folly Rd. & Camp Rd.	Charleston County Sheriff
220	Hwy. 78 & Ladson Rd.	Charleston County Sheriff
221	Hwy. 78 & College Park Rd.	Charleston County Sheriff
300 Folly Beach Police Department		
301	Center St. & Ashley Ave.	Folly Beach Police Dept.
302	Center St. at Folly River Bridge	Folly Beach Police Dept.
303	Folly Rd. at Oak Island Creek Bridge	Folly Beach Police Dept.
304	Folly Rd. & Sol Legare Creek Bridge	Folly Beach Police Dept.

County/Id	Location	Responsible Agency
400 Isle of Palms Police Department		
402	Palm Blvd & Highway 517	Isle of Palms Police Dept.
403	Palm Blvd. at Breech Inlet (as needed)	Isle of Palms Police Dept.
500 Mt. Pleasant Police Department		
501	Highway 17 Bypass at McGarth Darby	Mt. Pleasant Police Dept.
502	Highway 17 Bypass at Huston Northcutt	Mt. Pleasant Police Dept.
503	Highway 703 & Center St.	Mt. Pleasant Police Dept.
504	Highway 703 & 526 Bus.	Mt. Pleasant Police Dept.
505	Shem Creek Bridge	Mt. Pleasant Police Dept.
506	Coleman & McGarth Darby	Mt. Pleasant Police Dept.
507	Hwy. 703 & Rifle Range Rd.	Mt. Pleasant Police Dept.
508	Hwy. 17 & Long Point Rd.	Mt. Pleasant Police Dept.
509	Hwy. 17 & IOP Connector	Mt. Pleasant Police Dept.
510	IOP Connector& Rifle Range Rd	Mt. Pleasant Police Dept.
511	I-526 & Bowman Rd.	Mt. Pleasant Police Dept.
512	Mathis Ferry & Hwy 17N	Mt. Pleasant Police Dept.
600 North Charleston Police Department		
601	Rivers Ave. & Ashley Phosphate Rd.	N. Charleston Police Dept.
602	Rivers Ave. & Remount Rd.	N. Charleston Police Dept.
603	Remount Rd. & N. Rhett Ave.	N. Charleston Police Dept.
604	Rivers Ave. & Otranto	N. Charleston Police Dept.
605	Rivers Ave. & NAD Rd.	N. Charleston Police Dept.
606	Rivers Ave. & Reynolds Ave.	N. Charleston Police Dept.
607	Stall Rd. & Ashley Phosphate Rd.	N. Charleston Police Dept.

County/Id	Location	Responsible Agency
608	Rivers Ave. & Durant Ave.	N. Charleston Police Dept.
609	N. Rhett & I-526	N. Charleston Police Dept.
610	Rivers Ave. & Aviation Ave.	N. Charleston Police Dept.
611	Rivers Ave. & I-526	N. Charleston Police Dept.
700 South Carolina Highway Patrol		
701	Dorchester Rd. & I-26	SC Highway Patrol
702	Dorchester Rd. & Montague Ave.	SC Highway Patrol
703	Meeting St. & Hwy. 17 (I-26)	SC Highway Patrol
704	I-26 at S-49-Mt. Pleasant St.	SC Highway Patrol (2)
705	I-26 at S-46-Rutledge Ave.	SC Highway Patrol (2)
706	I-26 at SC-7-Cosgrove Ave.	SC Highway Patrol (4)
707	I-26 at S-62-Montague Ave.	SC Highway Patrol (4)
708	I-26 at I-526-Mark Clark Expressway	SC Highway Patrol (4)
709	I-26 at S-1342-Aviation Ave.	SC Highway Patrol (4)
710	I-26 at S-75-Ashley Phosphate Rd.	SC Highway Patrol (3)
711	Ashley Phosphate Rd & I-26 westbound on ramp	SC Highway Patrol (4)
712	I-26 & Hwy 52 Connector	SC Highway Patrol
713	I-26 at US-78	SC Highway Patrol
800 Sullivan's Island Police Department		
801	Jasper & Middle St. at Breech Inlet	Sullivans Island PD (2)
802	Jasper & 22 ½ Street	Sullivans Island PD
803	Middle Street & 22½ Street	Sullivans Island PD
804	Myrtle & 22 ½ Street	Sullivans Island PD

County/Id	Location	Responsible Agency
COLLETON COUNTY		
1	Highway US 21 & 17-A, to allow evacuating traffic to turn left and continue on Highway 21.	Colleton County Sheriff
2	Highway US 21 & Interstate 95, to ensure I-95 northbound traffic is allowing Highway 21 traffic to merge smoothly.	SC Highway Patrol (2)
3	Highway US 21 & Highway SC 61, to allow Highway SC 61 traffic to merge into the Highway US 21 evacuating traffic.	SC Highway Patrol (2)
4	Highway SC 64 & Highway 17, to allow Highway 17 traffic to smoothly merge into Highway SC 64 traffic.	Colleton County Sheriff
5	Highway SC 64 & Highway 17-A, to allow Highway 17-A traffic to smoothly merge into Highway SC 64 traffic	Walterboro Police Dept.
6	Highway SC 64 & Interstate 95, to ensure Highway SC 64 traffic is merging smoothly into the northbound I-95 traffic	SC Highway Patrol (2)
7	Highway SC 61 & Interstate 95, to ensure Highway SC 61 traffic is merging smoothly into the northbound I-95 traffic.	SC Highway Patrol (2)
DORCHESTER COUNTY		
1	Highway 61 & Highway 165	SC Highway Patrol (2)
2	Highway 61 & Highway 17-A	SC Highway Patrol (3)
3	Highway 61 & S-27, to block S-27 northbound and keep evacuating traffic moving on Highway 61	SC Highway Patrol (2)
4	Highway 642 & S-22, to direct evacuating traffic from Highway 642 onto S-22	SC Highway Patrol (2)

County/Id	Location	Responsible Agency
5	Highway 17-A & S-22	SC Highway Patrol (4)
6	S-22 & Highway US 78, to direct evacuating traffic from S-22 onto Highway US 78.	SC Highway Patrol (2)
7	Highway US 78 & Highway US 178, to direct evacuating traffic from Highway US 78 onto Highway US 178	SC Highway Patrol (2)
8	Highway US 178 & S-453	SC Highway Patrol (2)
9	Highway US 178 & Interstate 95, to ensure the traffic merges onto I-95 without causing a bottleneck	SC Highway Patrol (4)
10	Highway 165 & Highway US 17-A	SC Highway Patrol (4)
11	Highway SC 642 (Dorchester Road) & S-199	SC Highway Patrol (2)
12	Highway US 17-A & Highway US 78	SC Highway Patrol (4)
13	Highway US 17-A & Highway SC 642 (Dorchester Road)	SC Highway Patrol (3)
14	Interstate 26 & Interstate 95, to control the merging of traffic from I-26 onto I-95	SC Highway Patrol (8)
LEXINGTON COUNTY		
No traffic control points		
ORANGEBURG COUNTY		
1	Highway 321 & Highway 332, to block 332 traffic and allow evacuating traffic on Highway 321 to flow smoothly	Norway Police Dept. (2)
2	Highway 321 & Highway 400, to block 400 traffic and allow evacuating traffic on Highway 321 to flow smoothly	Orangeburg County Sheriff (2)

County/Id	Location	Responsible Agency
3	Highway 321 & Highway 4, to block Highway 4 traffic and allow evacuating traffic on Highway 321 to flow smoothly	SC Highway Patrol (Monitor)
4	Highway 321 & Highway 389, to block 389 traffic and allow evacuating traffic on Highway 321 to flow smoothly.	SC Highway Patrol (Monitor)
5	Highway 321 & Highway 78, to block 78 traffic and allow evacuating traffic on Highway 321 to flow smoothly	North Police Dept. (2)
6	Highway 21 & Highway 78, to block Highway 78 traffic and allow evacuating traffic on Highway 21 to flow smoothly	Branchville Police Dept. (2)
7	Highway I-26 & I-95 to assist with traffic off I-95 onto I-26 to allow evacuation traffic to flow on I-26 smoothly	SC Highway Patrol (6), Orangeburg County Sheriff (6)
8	Highway I-26 & US 601, to allow traffic to smoothly merge off of US 601 onto I-26 westbound.	SC Highway Patrol (4)
RICHLAND COUNTY		
No traffic control points		

Traffic Management / Law Enforcement

Southern Coastal Conglomerate Annex

1. General. Evacuation of the population away from vulnerable areas is one of the most crucial issues in protecting lives in the face of an approaching hurricane. The basic traffic concept is to allow traffic to flow in its normal patterns and to use existing traffic control devices to control the flow. To supplement these existing traffic control devices, law enforcement personnel will staff selected Traffic Control Points (TCPs) within the conglomerate. Each TCP has been established to provide assistance to the evacuating populace. The various law enforcement agencies working in the conglomerate will be responsible for pre-determined TCPs.

2. Traffic Control Point (TCP) Responsibilities. The following TCPs were compiled by the South Carolina Department of Public Safety/South Carolina Highway Patrol in cooperation with local law enforcement agencies. This effort was coordinated by the South Carolina Law Enforcement Division (SLED) acting as the primary agency for the law enforcement emergency support function (ESF). Many of the TCPs may be staffed by the South Carolina National Guard. In the listing below, where personnel requirements are indicated, the staffing represents a twenty-four hour period.

County/Id	Location	Responsible Agency
AIKEN COUNTY		
1	Highway 278 & Highway 125, to block Highway 125 traffic and allow evacuating traffic on Highway 278 to flow smoothly.	Aiken County Sheriff
2	Highway 278 & Highway 1, to block Highway 1 traffic and allow evacuating traffic on Highway 278 to flow smoothly.	Aiken County Sheriff
3	Highway 278 & Highway 19, to block Highway 19 traffic and allow evacuating traffic on Highway 278 to flow smoothly.	Aiken County Sheriff
ALLENDALE COUNTY		

County/Id	Location	Responsible Agency
1	Highway 3 & Highway 301, to block Highway 3 southbound traffic and allow evacuating traffic to turn left onto Highway 301.	SC Highway Patrol (2)
2	Highway 278 & Highway 321, to control the intersection, and allow these 2 evacuation routes to move as smoothly as possible.	Fairfax Police Dept. (2)
3	Highway 278, Highway 301 & Highway 125, to block 310 and 125 traffic and allow the evacuating traffic on Highway 278 to flow smoothly.	Allendale Police Dept. (2)
4	Highway 278, Highway 301 & Highway 81, to block 301 and 81 traffic and allow the evacuating traffic on Highway 278 to flow smoothly.	Allendale Police Dept. (2)
5	Highway 321 & Highway 641, to block 641 traffic and allow evacuating traffic on Highway 321 to flow smoothly.	Allendale County Sheriff (Monitor)
6	Highway 321 & Highway 301, to block 301 traffic and allow evacuating traffic on Highway 321 to flow smoothly.	Allendale County Dept. (2)
BAMBERG COUNTY		
1	Highway 321 & 301, to block 301 traffic and allow evacuating traffic on Highway 321 to flow smoothly.	Bamberg County Sheriff (Monitor)
2	Highway 321 & Highway 78, to block 78 and allow evacuating traffic on Highway 321 to flow smoothly.	Denmark Police Dept. (2)
3	SC 64 & Highway 301	SC Highway Patrol (Monitor)
4	SC 64 & Highway 321	SC Highway Patrol (Monitor)
BARNWELL COUNTY		
1	Highway 278 & Highway 39, to block Highway 39 traffic and allow evacuating traffic on Highway 278 to flow smoothly.	Barnwell County Sheriff (Monitor)

County/Id	Location	Responsible Agency
2	Highway 278 & Highway 3, to block Highway 3 and allow evacuating traffic to continue on Highway 278.	Barnwell Police Dept. (2)
3	Highway 278 & Highway 70, to block Highway 70 traffic and allow evacuating traffic on Highway 278 to flow smoothly.	Barnwell Police Dept. (2)
4	Highway 278 & Highway 64, to block 64 traffic & allow evacuating traffic on Highway 278 to flow smoothly.	Barnwell Police Dept. (2)
BEAUFORT COUNTY		
North of Broad River		
1	Sea Island Parkway & Martin Luther King Dr, to block off traffic on Sea Island Parkway and allow traffic from martin Luther King to enter as necessary.	Beaufort County Sheriff
2	Polawana Road & Sea Island Parkway, to block off traffic on Sea Island Parkway and allow traffic from Polawana Road to enter as necessary.	Beaufort County Sheriff
3	Highway 802 & US 21, to monitor intersection and allow 802 traffic to enter US 21.	SC Highway Patrol (2)
4	Lady's Island Drive & Meridian Road, to block off traffic on Lady's Island Drive and allow traffic from Meridian Road to enter as necessary.	Beaufort County Sheriff
5	Island Causeway & Lady's Island Drive, to block off traffic on Lady's Island Drive and allow traffic from Island Causeway to enter as necessary.	Beaufort County Sheriff
6	Ribaut Road & Highway 802, to block intersection and allow traffic to enter Ribaut Road.	Port Royal Police Dept.
7	Paris Island at Highway 802, to block road as necessary to allow Paris Island traffic to enter Highway 802.	Paris Island Military Police
8	Robert Smalls Parkway & Highway 802, to block off Broad River Bridge and allow only emergency vehicles to cross. Route all other to Highway 21.	SC Highway Patrol (4)

County/Id	Location	Responsible Agency
9	Highway 280 & Highway 170, to monitor intersection and intervene when necessary, to allow traffic to flow freely.	SC Highway Patrol (2)
10	Highway 280 & US 21, to monitor intersection and intervene when necessary, to allow traffic to flow freely.	SC Highway Patrol (2)
11	Highway 116 & US 21, to monitor intersection and intervene when necessary, to allow traffic to flow freely.	SC Highway Patrol (2)
12	Grays Hill Intersection, to block traffic as necessary to allow traffic to enter Highway 21.	Beaufort County Sheriff
13	Gardens Corner, to block intersection to allow traffic from Beaufort area to enter south bound lane.	SC Highway Patrol (2)
14	Highway 17 & Sheldon Church Road, to block off Old Sheldon Church Road and allow no traffic to enter.	SC Highway Patrol (2)
15	Highway 17 & Castle Hall Road, to monitor intersection to reduce congestion.	SC Highway Patrol (2)
16	Bay & Carteret, to monitor intersection and intervene if necessary.	Beaufort Police Dept. (Monitor)
17	Boundary & Charles, to monitor intersection and intervene if necessary.	Beaufort Police Dept. (Monitor)
18	Rabat Road & Boundary, to monitor intersection and intervene if necessary to allow traffic to flow freely.	Beaufort Police Dept. (Monitor)
19	Highway US 21 & Highway 170, to monitor intersection and intervene when necessary, to allow traffic to flow freely.	Beaufort Police Dept. (Monitor)
20	Hwy 280 & Broad River Rd.	SC Highway Patrol (2)
21	Parris Island Gateway & Savannah Hwy, to allow traffic to flow freely	SC Highway Patrol (2)
Hilton Head		
1	Coligny Plaza, to block the appropriate roads to allow traffic to enter US 278.	Beaufort County Sheriff

County/Id	Location	Responsible Agency
2	Pope Avenue & Cordillo Parkway, to block the appropriate roads to allow traffic to enter US 278.	Beaufort County Sheriff
3	Sea Pines Circle, to block appropriate lanes to allow traffic to enter US 278.	Beaufort County Sheriff
4	Palmetto Dunes & US 278, to block US 278 as appropriate, to allow residents from Palmetto Dunes to enter US 278.	Beaufort County Sheriff
5	Shipyard & US 278, to block US 278 as appropriate , to allow residents from Shipyard to enter US 278 traffic.	Beaufort County Sheriff
6	Folly Field & US 278, to block roads as appropriate, to allow traffic to enter US 278.	Beaufort County Sheriff
7	Port Royal Plantation & US 278, to block US 278 as appropriate, to allow residents to enter US 278.	Beaufort County Sheriff
8	Mathews Drive & US 278, to block appropriate roads to allow traffic to enter US 278.	Beaufort County Sheriff
9	Spanish Wells Road / Cross Island Route & US 278, to block appropriate roads to allow traffic to enter US 278.	SC Highway Patrol (20)
10	Long Cove Club & US 278, to block US 278 as appropriate, to allow residents to enter US 278.	Beaufort County Sheriff
11	Indigo Run / Hilton Head Plantation & US 278, to block US 278 as appropriate, to allow residents to enter US 278.	Beaufort County Sheriff
12	Beach City Road & US 278, to block US 278 as appropriate to allow traffic from Beach City Road to enter US 278.	Beaufort County Sheriff
13	Squire Pope Road & US 278, to block US 278 as appropriate to allow traffic from Beach City Road to enter US 278.	Beaufort County Sheriff
14	Windmill Harbor & US 278, to block US 278 as appropriate to allow traffic from Windmill Harbor to enter US 278.	Beaufort County Sheriff

County/Id	Location	Responsible Agency
15	Arrow Road & William Hilton Parkway.	Beaufort County Sheriff (4)
16	Arrow Road & Target Road	Beaufort County Sheriff (2)
17	Target Road & Palmetto Bay Road	Beaufort County Sheriff (2)
18	Point Comfort Road & Palmetto Bay Road.	Beaufort County Sheriff (2)
19	Archer Road and Palmetto Bay Road.	Beaufort County Sheriff (2)
20	Spanish Wells Road and Marshland Road.	Beaufort County Sheriff (2)
21	Marshland Road and Cross Island Parkway.	Beaufort County Sheriff (2)
22	Cross Island Parkway & ramp from Marshland Road.	Beaufort County Sheriff (2)
Bluffton		
1	US 278 at Buckingham, to block US 278 as appropriate, to allow residents from Buckingham to enter US 278.	SC Highway Patrol (2)
2	US 278 at The Gatherings, to block US 278 as appropriate, to allow residents from The Gathering to enter US 278.	SC Highway Patrol (2)
3	US 278 at Moss Creek, to block US 278 as appropriate, to allow residents from Moss Creek to enter US 278.	SC Highway Patrol (2)

County/Id	Location	Responsible Agency
4	US 278 at Burnt Church Road, to block off Burnt Church Road when no shelters are opened. If shelters are open in Bluffton, allow cars to enter Burnt Church Road. No traffic will be allowed to enter Highway 278 from Burnt Church Road. Traffic control point should be manned at Fernlakes Subdivision and route traffic south onto Burnt Church Road and route to Highway 46 through Bruin St. A sign stating road closed ahead should be placed on Burnt Church Road at Bruin St and road closed sign on Burnt Church Road at Fernlakes subdivision.	SC Highway Patrol (2)
5	US 278 & Highway 46, to block off Highway 46 when no shelters are opened and restrict access to residents only. When shelters are opened in the Bluffton area are open, allow cars to enter Highway 46.	SC Highway Patrol (2)
6	US 278 & Highway 170 at McGarveys, to allow traffic to exit US 278 onto Highway 170. The traffic will only be allowed to turn right towards the Career Education Center.	SC Highway Patrol (4)
7	Highway US 278 & Simmonsville Road, to block off S-474 and to assist traffic from S-474 to enter US 278.	SC Highway Patrol (2)
8	Highway US 278 & Buck Island Road, to block off Buck Island Road to assist traffic from Buck Island Road to enter US 278 traffic.	SC Highway Patrol (2)
9	US 278 at Rose Hill, to block US 278 as appropriate, to allow residents to enter US 278.	SC Highway Patrol (2)
10	Highway 46 at Highway 170, to block Highway 46 and route traffic from Highway 170 towards Hardeeville. Highway 170 should be blocked as appropriate, to allow traffic from Bluffton to enter into the traffic flow. No traffic from Bluffton should be allowed to turn north onto Highway 170, except emergency vehicles. The only traffic turning left should be residents of the Bluffton area or emergency vehicles returning to Hilton Head.	SC Highway Patrol (3)

County/Id	Location	Responsible Agency
11	Highway 170 & Gibblet Road, to block off Gibblet Road and allow only residents and emergency traffic returning to Hilton Head.	SC Highway Patrol (2)
12	US 278 at Colleton River Plantation, to block US 278 as appropriate, to allow residents from Colleton River to enter US 278.	SC Highway Patrol (2)
13	US 278 at Belfair Plantation, to block US 278 as appropriate, to allow residents from Belfair to enter US 278.	SC Highway Patrol (2)
14	US 278 at Sun City, to block Highway 170 to Sun City traffic to enter highway. The Sun City traffic will be routed south on Highway 170 to Highway 46. No traffic will be allowed to turn left onto Highway 46 towards Ridgeland.	SC Highway Patrol (2)
15	Burnt Church Road at Bruin Street, to block Burnt Church Road and divert traffic to Bruin St. Local traffic only should be allowed down Brunt Church Road. This action is being taken to prohibit traffic from entering US 278.	SC Highway Patrol (2)
16	Highway 170 at Callawassie Road & Snake Road, to block intersection as necessary to allow traffic from Callawassie to enter Snake Road. When the Broad River Bridge is closed all traffic should be sent down Snake Road.	SC Highway Patrol (2)
COLLETON COUNTY		
1	Highway US 21 & 17-A, to control the intersection and allow evacuating traffic to turn left and continue on Highway 21.	Colleton County Sheriff
2	Highway US 21 & Interstate 95, to control the intersection and ensure I-95 northbound traffic is allowing Highway 21 traffic to merge smoothly.	SC Highway Patrol (2)

County/Id	Location	Responsible Agency
3	Highway US 21 & Highway SC 61, to control the intersection and allow Highway SC 61 traffic to merge into the Highway US 21 evacuating traffic.	SC Highway Patrol (2)
4	Highway SC 64 & Highway 17, to control the intersection and allow Highway 17 traffic to smoothly merge into Highway SC 64 traffic.	Colleton County Sheriff
5	Highway SC 64 & Highway 17-A, to control the intersection and allow Highway 17-A traffic to smoothly merge into Highway SC 64 traffic.	Walterboro Police Dept.
6	Highway SC 64 & Interstate 95, to control the intersection and ensure Highway SC 64 traffic is merging smoothly into the northbound I-95 traffic.	SC Highway Patrol (2)
7	Highway SC 61 & Interstate 95, to control the intersection and ensure Highway SC 61 traffic is merging smoothly into the northbound I-95 traffic.	SC Highway Patrol (2)
HAMPTON COUNTY		
1	Highway 321 & Highway 119, to control the intersection and allow the traffic to flow smoothly.	Hampton County Sheriff (2)
2	Highway 321 & Highway 333, to control the intersection and allow evacuating traffic to flow smoothly.	Hampton County Sheriff (2)
3	Highway 321 & Highway 3, to direct the left lane of traffic onto Highway 3, and allow the right lane to continue straight on Highway 321.	Estill Police Dept. (2)
4	Highway 3 & Highway 19, to control traffic and allow evacuating traffic to turn right and continue on Highway 3.	SC Highway Patrol (2)
5	Highway 3 & Highway 56, to block Highway 56 and allow evacuating traffic to continue to flow freely.	SC Highway Patrol (2)
6	Highway 278 & Highway 68, to control traffic and allow traffic from Highway 68 to merge into the Highway 278 traffic.	SC Highway Patrol (2)

County/Id	Location	Responsible Agency
7	Highway 278, Highway 50 & Highway 63, to block 50 and 63, and allow evacuating traffic on Highway 278 to flow smoothly.	Varnville Police Dept. (2)
8	Highway 278 & Highway 601, to control the intersection and allow traffic from Highway 601 to merge into the Highway 278 traffic.	Hampton Police Dept. (2)
9	Highway 278 & Highway 363, to control the intersection and allow traffic from Highway 363 to merge into the Highway 278 traffic.	Hampton Police Dept. (2)
10	I-95 Exit & Highway SC 68, to control intersection and allow exiting I-95 traffic to merge with westbound SC 68 traffic.	Hampton County Sheriff (2)
JASPER COUNTY		
1	Highway SC 46 at the Shell Station, to allow traffic to flow freely.	SC Highway Patrol (2)
2	Highway SC 46 at Highway US 17 in Hardeeville, to allow traffic to flow freely.	Hardeeville Police Dept. (2)
3	Highway 46 at 17 & I-95 at Hardeeville, to allow traffic to flow freely.	SC Highway Patrol (4)
4	Highway 141 & US 278, to allow traffic to flow freely.	SC Highway Patrol (2)
5	US 278 at Old House, to allow traffic to flow freely.	SC Highway Patrol (2)
6	US 278 in Ridgeland, to allow traffic to flow freely.	Ridgeland Police Dept. (2)
7	Highway SC 462 at Coosawhatchie, to allow traffic to flow freely.	SC Highway Patrol (2)
8	Highway SC 462 & US 278, to allow traffic to flow freely.	SC Highway Patrol (2)
9	Highway 278 & Interstate 95 Exit 8, to control intersection.	SC Highway Patrol (4)

County/Id	Location	Responsible Agency
10	Highway 278 & Snake Road, to block Highway 278 as necessary to allow traffic from Snake Road to enter.	SC Highway Patrol (2)
ORANGEBURG COUNTY		
1	Highway 321 & Highway 332, to block 332 traffic and allow evacuating traffic on Highway 321 to flow smoothly.	Norway Police Dept. (2)
2	Highway 321 & Highway 400, to block 400 traffic and allow evacuating traffic on Highway 321 to flow smoothly.	Orangeburg County Sheriff (2)
3	Highway 321 & Highway 4, to block Highway 4 traffic and allow evacuating traffic on Highway 321 to flow smoothly.	SC Highway Patrol (Monitor)
4	Highway 321 & Highway 389, to block 389 traffic and allow evacuating traffic on Highway 321 to flow smoothly.	SC Highway Patrol (Monitor)
5	Highway 321 & Highway 78, to block 78 traffic and allow evacuating traffic on Highway 321 to flow smoothly.	North Police Dept. (2)
6	Highway 21 & Highway 78, to block Highway 78 traffic and allow evacuating traffic on Highway 21 to flow smoothly.	Branchville Police Dept. (2)
7	Highway I-26 & I-95 to assist with traffic off I-95 onto I-26 to allow evacuation traffic to flow on I-26 smoothly.	SC Highway Patrol (6), Orangeburg County Sheriff (6)
8	Highway I-26 & US 601, to allow traffic to smoothly merge off of US 601 onto I-26 westbound.	SC Highway Patrol (4)

APPENDIX C

SOUTH CAROLINA HURRICANE EVACUATON RESTUDY DATA CD

APPENDIX D

SOUTH CAROLINA HURRICANE SURGE ATLAS – Printed Separately

APPENDIX E

SOUTH CAROLINA HURRICANE EVACUATON RESTUDY PUBLIC INFORMATION CD

APPENDIX F

SOUTH CAROLINA HURRICANE EVACUATON RESTUDY TRANSPORTATION ANALYSIS – Printed Separately

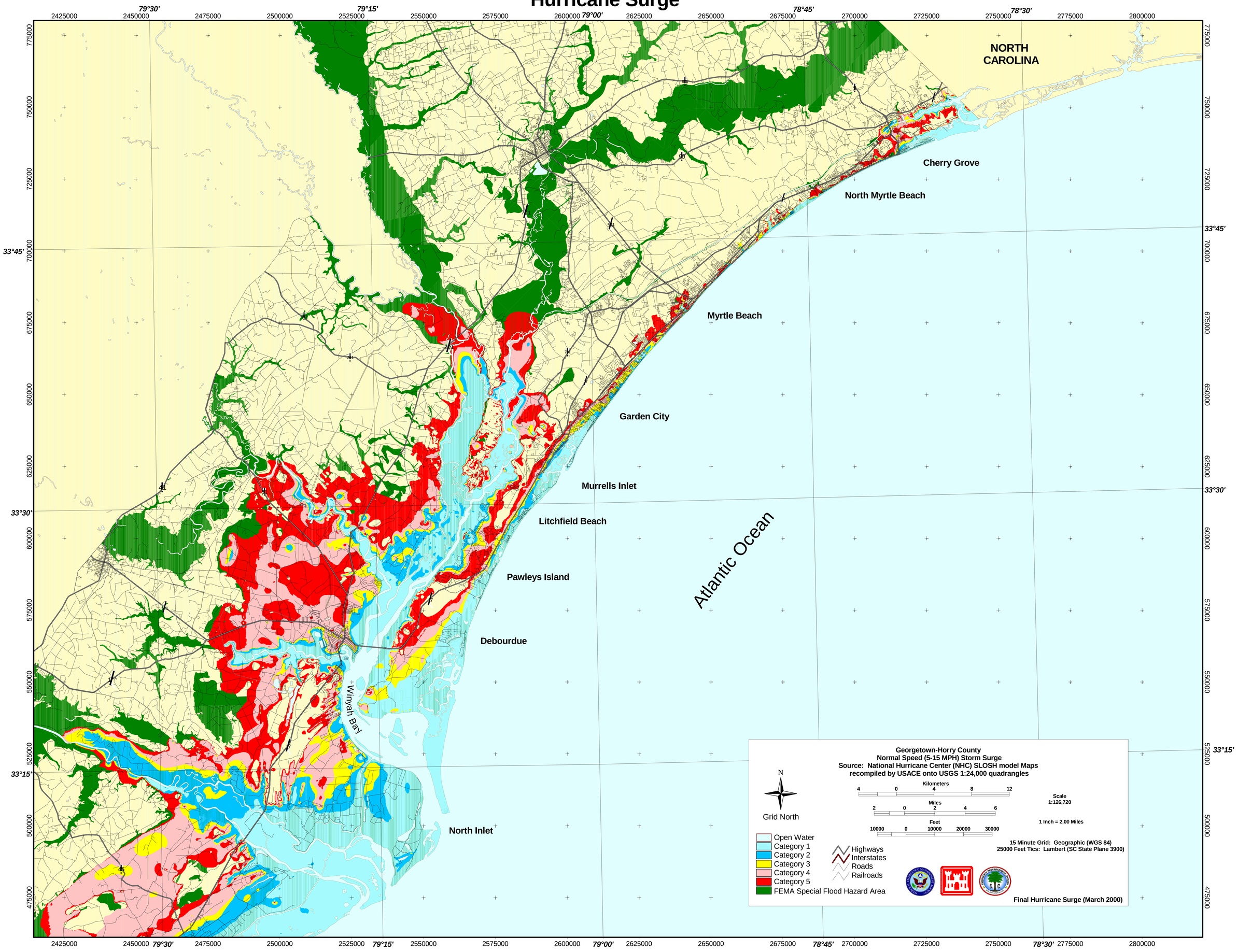
APPENDIX G

SOUTH CAROLINA HURRICANE EVACUATON RESTUDY TRANSPORTATION ANALYSIS TRANSPORTATION MODEL SUPPORT DOCUMENT – Printed Separately

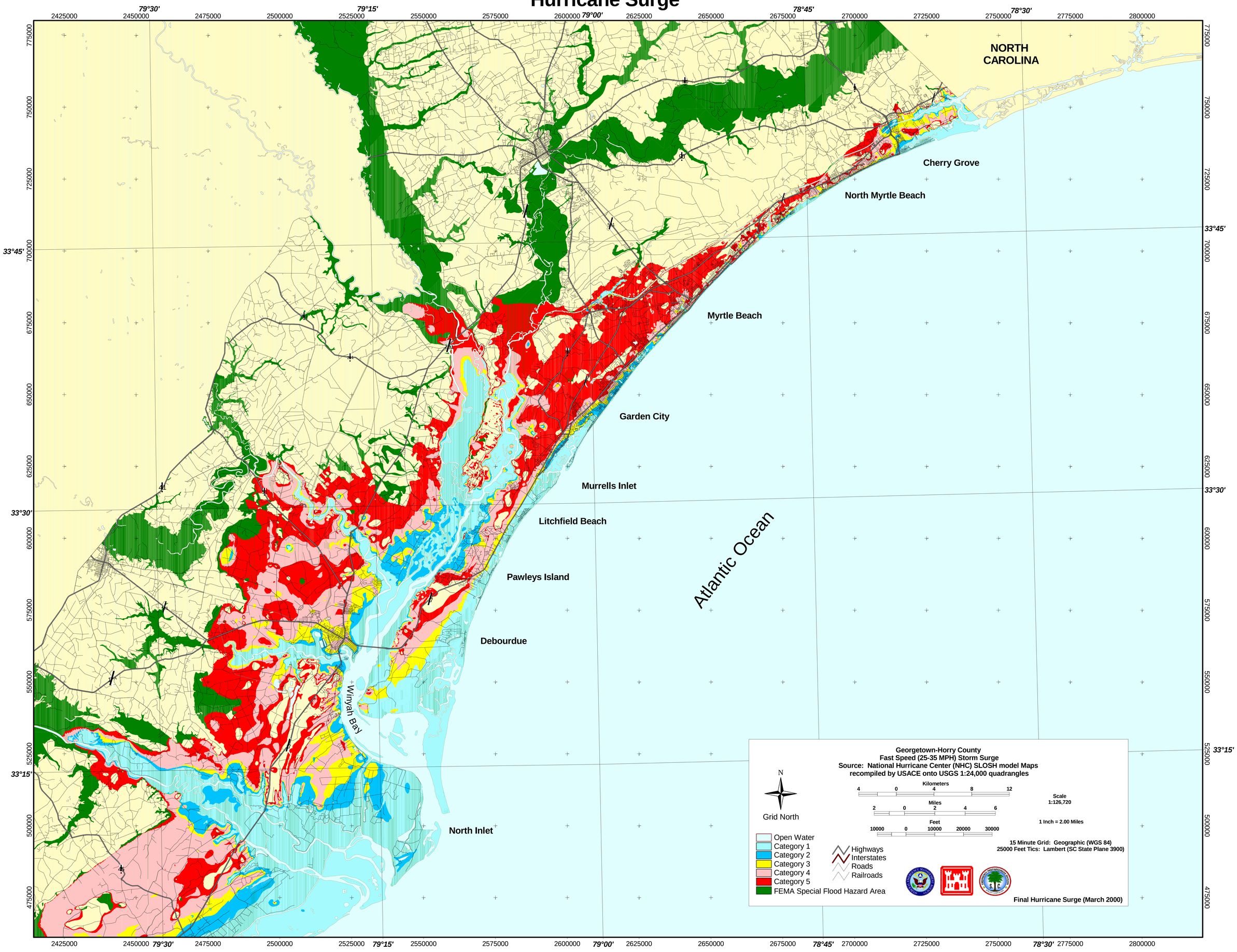
APPENDIX H

SOUTH CAROLINA HURRICANE EVACUATON RESTUDY
CONGLOMERATE WALL MAPS

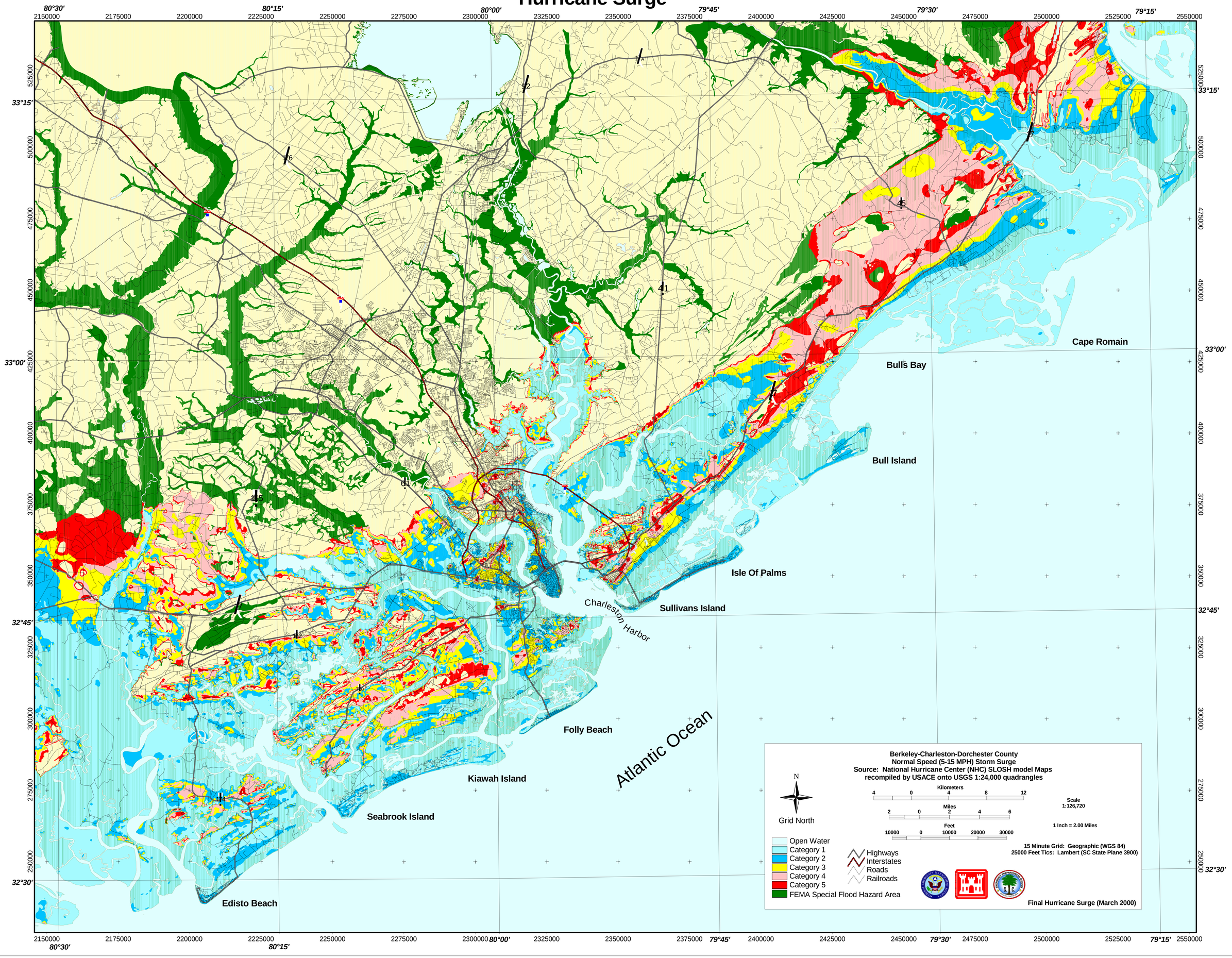
Georgetown-Horry County
Hurricane Surge



Georgetown-Horry County
Hurricane Surge



Berkeley-Charleston-Dorchester County
Hurricane Surge



Berkeley-Charleston-Dorchester County
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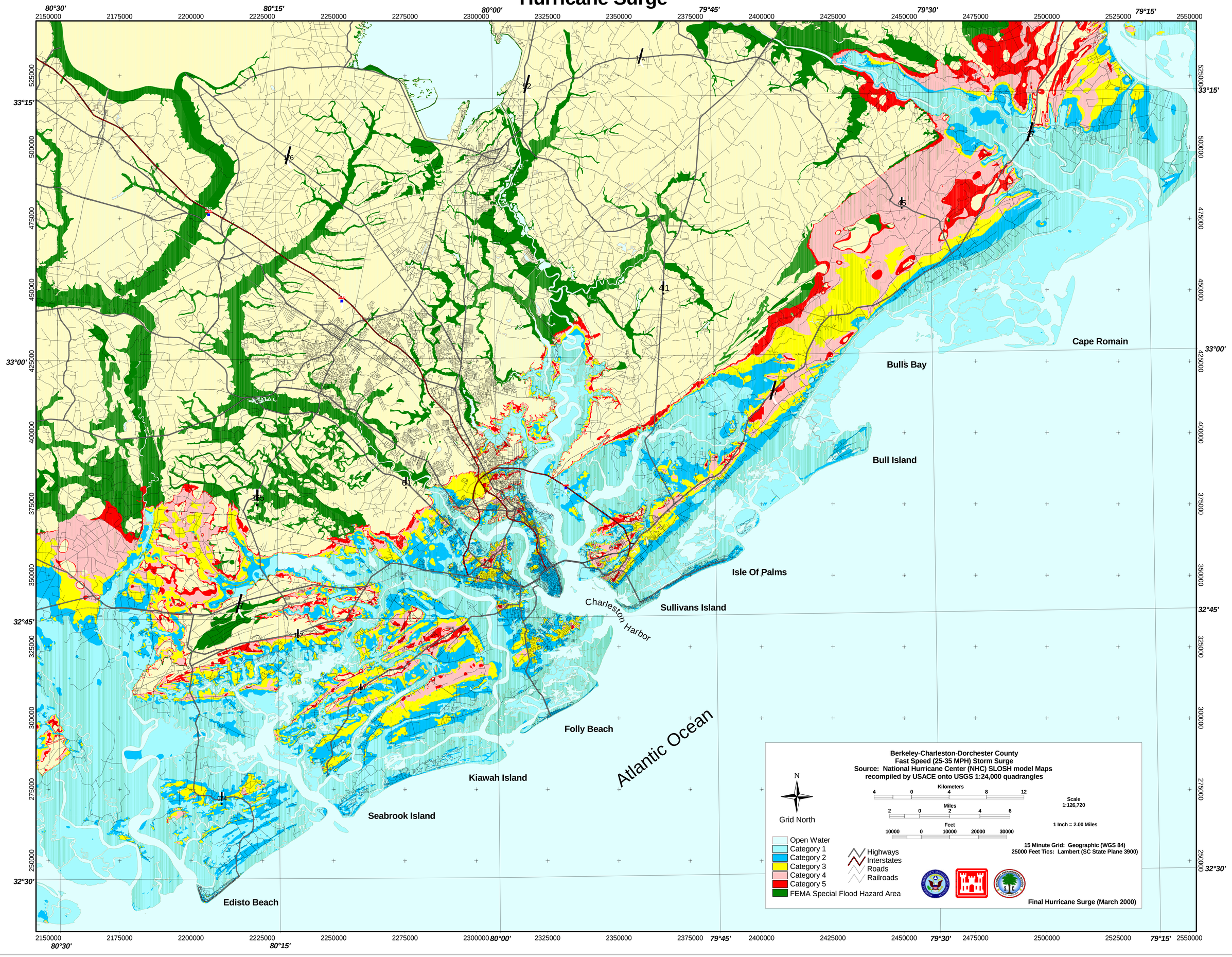
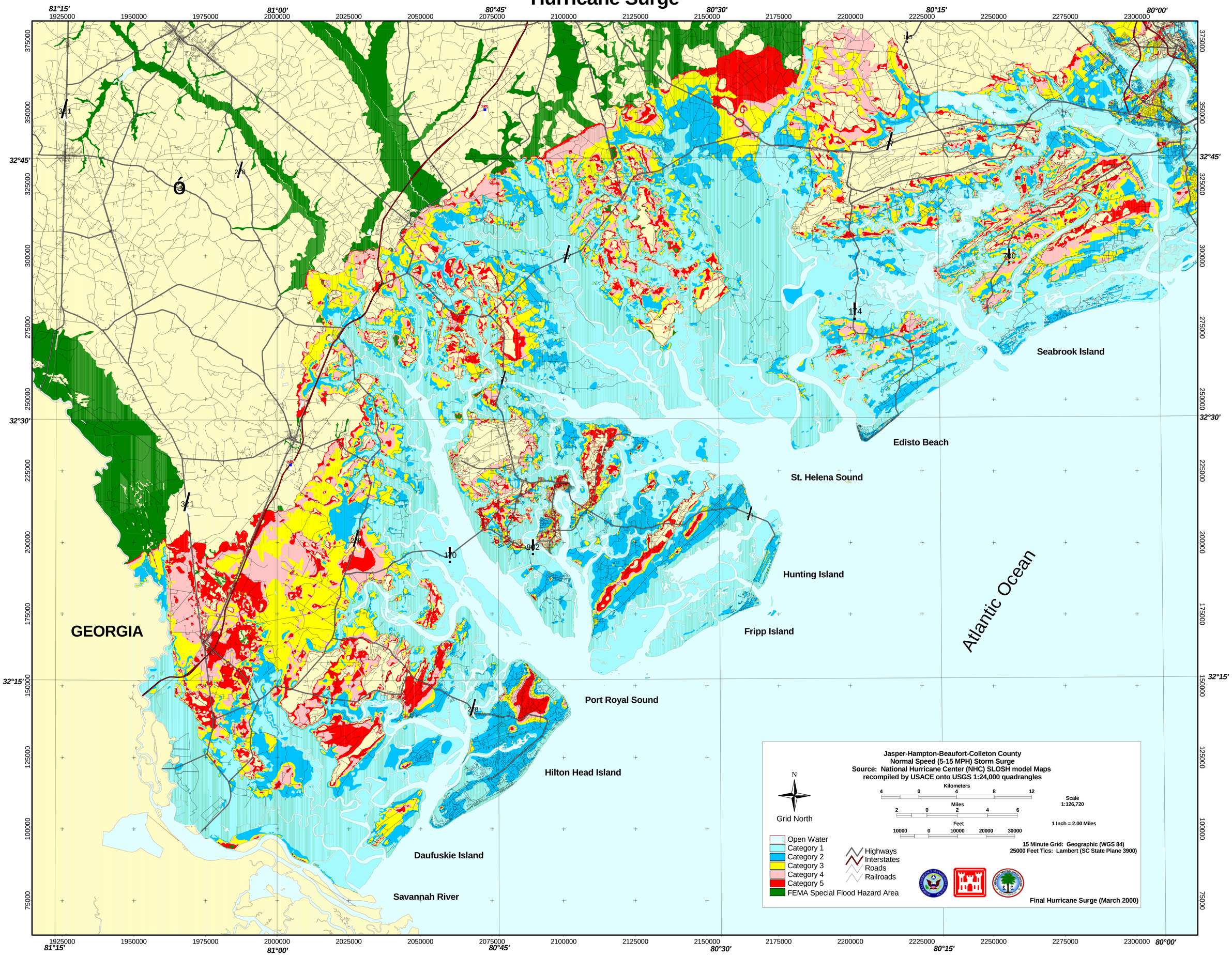
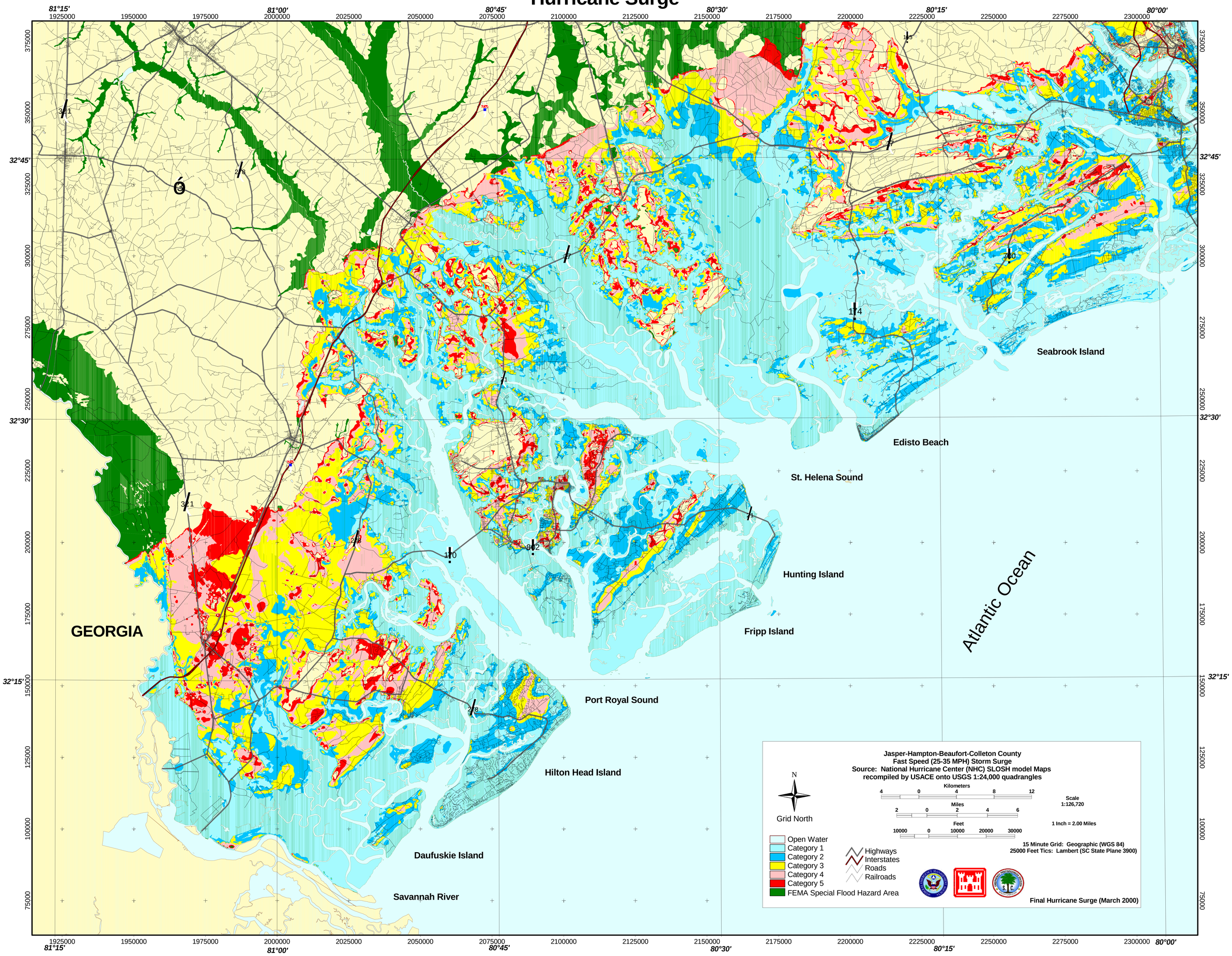


Jasper-Hampton-Beaufort-Colleton County
Hurricane Surge



Jasper-Hampton-Beaufort-Colleton County
Hurricane Surge